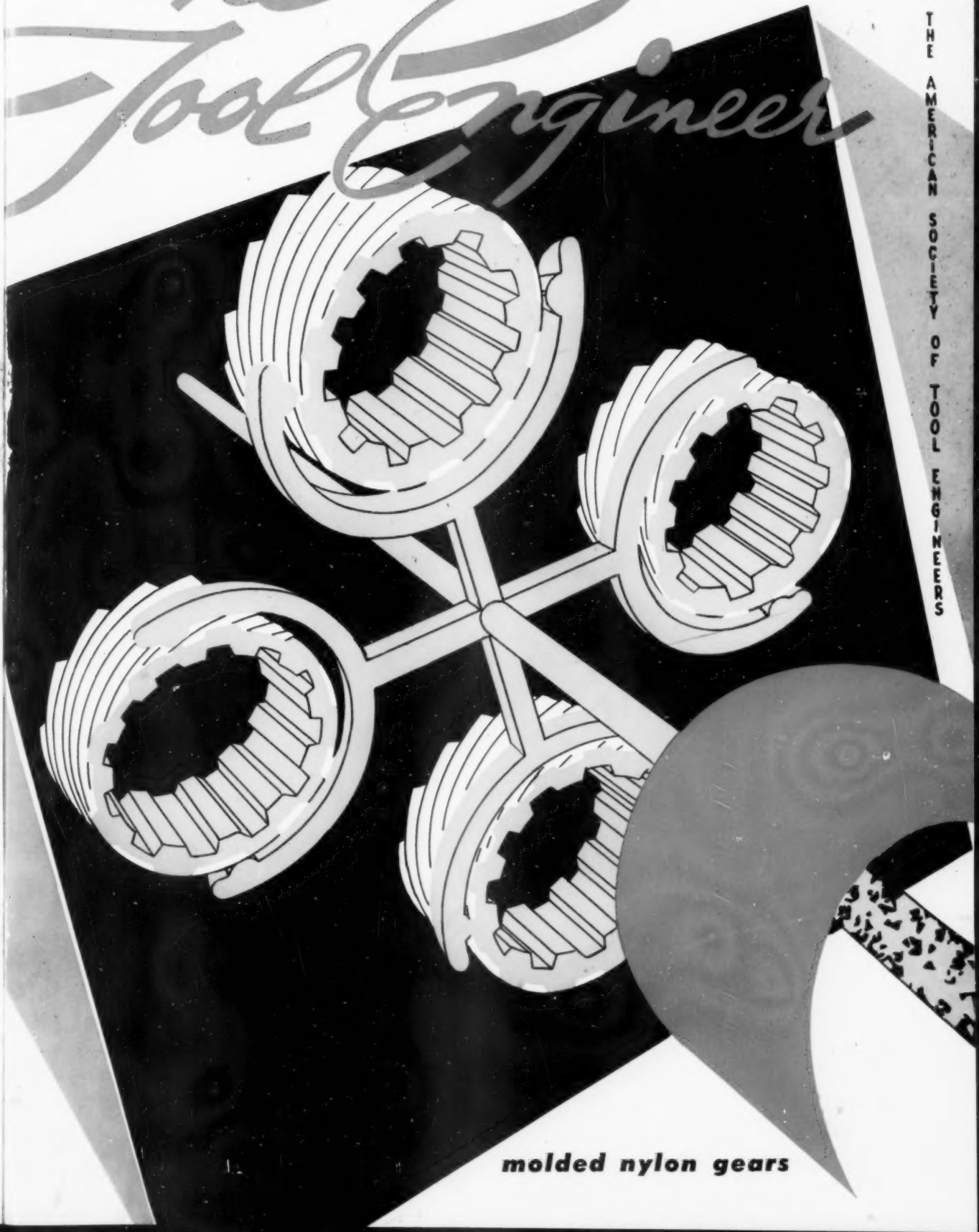
JULY 1954

the Tool Engineer

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS



molded nylon gears

for want of a horse the smith was lost

THE blacksmith shop was a busy place . . . when horsepower came "on the hoof". But when the first gasoline engine coughed and sputtered into life, the days of the village blacksmith were numbered.

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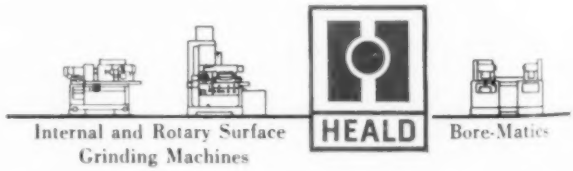
Competition is wonderful when you're *ahead* of it. Our business is to keep you there. That's why IT PAYS TO COME TO HEALD.



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Cover: The worm gear clutch is a relatively simple production item until it is injection molded of nylon. In the article beginning on page 61, Louis D. Martin clears some of the mystery from the shrinkage characteristics of nylon and indicates how tooling should be designed.

The Tool Engineer

Volume XXXIII, No. 1 July 1954

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The Tool Engineer

As Basic as Tools

Fundamentally as basic as tools themselves are the controls for the motors which drive them. As production machines become more and more complex with cycle controls and interlocks, their circuits become more involved and are of greater concern in the production schedule.

In highly integrated operations, controls not only assure proper sequencing but also protect machines, work in process, equipment and operators from harm. Protective devices, often regarded as necessary evils, assure that any fault will be detected so that it may be corrected before serious damage results, with corresponding loss in production time.

Whether the tool is actuated hydraulically, pneumatically or electrically, the primary power as well as the control circuits are usually electrical. These circuits often appear so complicated and confusing as to defy analysis by anyone except an expert. Yet, if any circuit is broken down into its circuit paths, the building-block components used in each path are readily understood. The functions of each become obvious.

So much specialized information on circuitry has been published that the basic interrelations of building blocks have become obscured. To help remove this unwarranted mystery and to aid the tool engineer in a better understanding of the control for an automatic process — in operation or being designed — a series of articles on fundamentals of control is being initiated in this issue.

In this first article, the building blocks for power circuits are catalogued in an organizational chart. Any path in this chart, from the power source to the motor drive, will develop a workable control. The blocks are arranged in horizontal bands to indicate their function and interrelation. A study of this chart and the diagrams in the article will show how each block fits in a control circuit. Like any other problem in tool engineering, proper design or selection becomes apparent when the elements are understood and analyzed individually.

John W Greve

EDITOR

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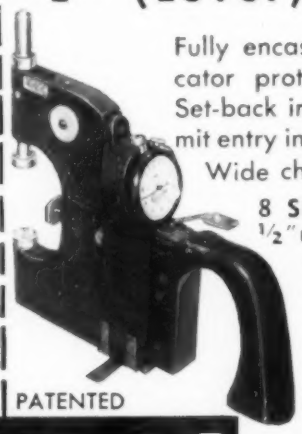

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We invite your investigation and trial of these new gages, each designed to help YOU.

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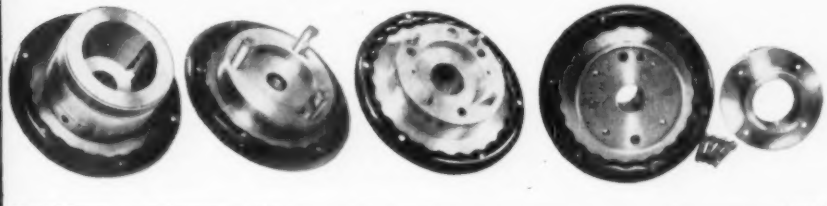

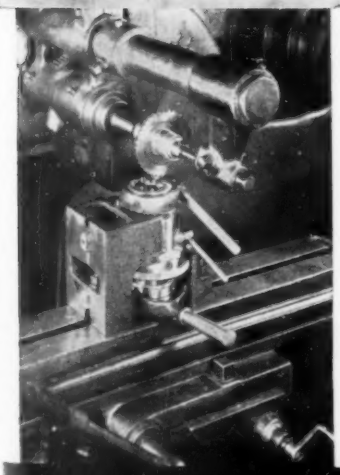

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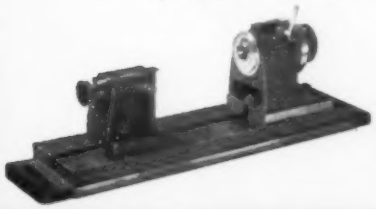
The way to increased production is to hold work accurately and provide for rapid indexing. HARDINGE Collet Index Fixtures—H-4 for Tool Room and Inspection Departments; HV-4 for Production Departments—will help increase production on either new or old machines. Planned interchangeability for a variety of applications. Buy these standard fixtures instead of making expensive special fixtures



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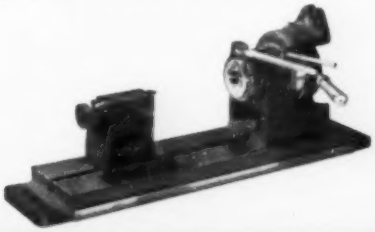

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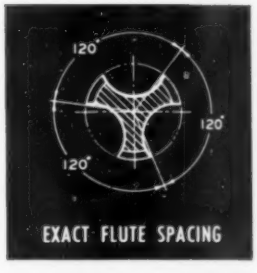

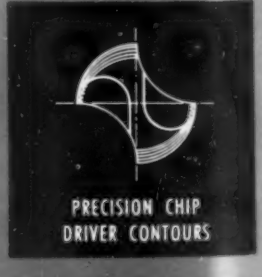

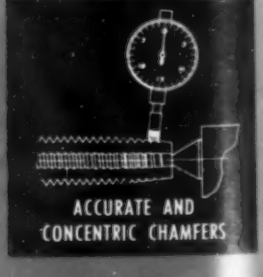

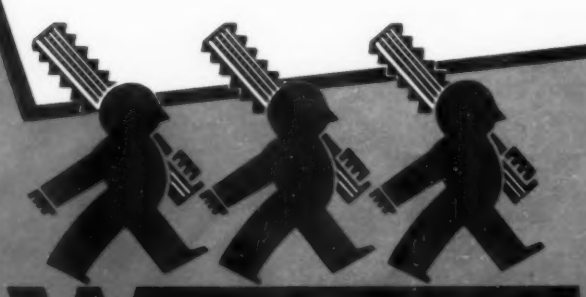

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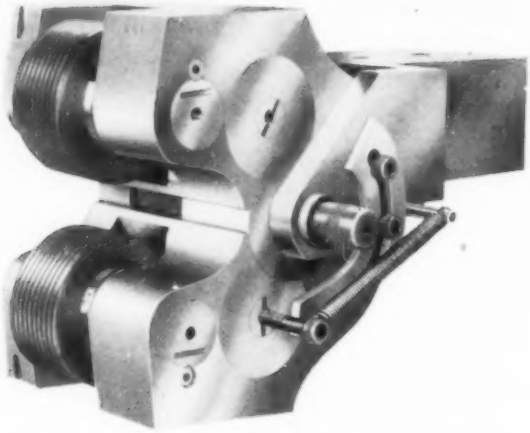
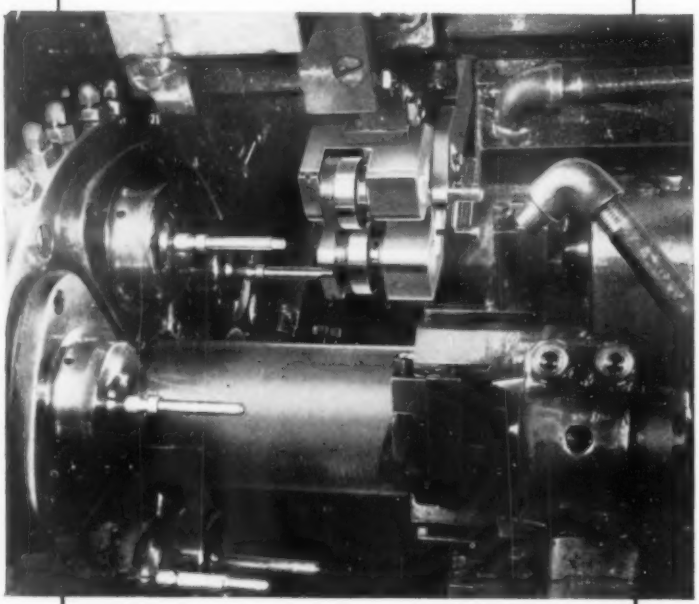


Improved *LANROLL* Attachment

for Precision Thread Rolling on Automatics



The new #18 LANROLL Attachment is shown on a $^{9}/_{16}$" RA6 Acme-Gridley Automatic at the Mac-it Parts Company in Lancaster, Pa. $^{1}/_{4}$" 20-pitch threads $^{9}/_{32}$" long are being rolled on stripper bolts of 4140 steel to a Class 4 (Class 3 required) fit within .012" of the shoulder with excellent thread finish.

376

Important improvements for economical thread rolling to Class 4 limits have resulted from changes in the design and construction of the LANROLL Attachment for automatic screw machines.

These improvements, which insure a degree of stabilization between the workpiece and the attachment never previously obtained in a tool of this type, provide:

(1) A well-balanced micro structure of the workpiece through reduced sidewise pressures between the rolls and threads produced.
(2) Low gear-tooth and thrust-bearing loads.
(3) Thread rolling solid to the shoulder with no danger of roll damage.
(4) Longer roll life as rolling wear is distributed equally between the two rolls.
(5) Precision rolling of coarse pitch threads to Class 4 fit without drunkenness.

The improved LANROLL Attachment is furnished in two sizes: the #18 Attachment to permit rolling of #5-44 pitch to $^{1}/_{2}$"—13 pitch threads up to $^{13}/_{16}$" in length; and the #20 Attachment for rolling $^{3}/_{8}$"—24" pitch to 1"—8 pitch threads up to $^{15}/_{16}$" in length. A new system of size adjustment assures operation of the Attachment for every size within its range as though it were exclusively engineered for the particular workpiece being threaded.

The improved LANROLL Attachment has other important new features: *Attachment Tipping* to avoid indexing interference, allowing a more rugged construction and the use of larger rolls, resulting in an increased number of starts and longer roll life; *Precise Timing* to avoid experimentation or near-guess timing which may result in damage to the rolls on initial rolling; *Adjustment for Taper*, to eliminate any taper which may occur, that can be made without removing the Attachment from the machine.

More complete information will be sent on request. Please send specifications when writing.

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Reports from every section of the country tell how the freer cutting, longer lasting R50 and B9 add the profit-boosting "TOUCH of GOLD"

Here's what they say about –

The R50

143 more cuts
California mine bit manufacturer rates R50 rubber cut-off wheel best ever used. Gave 735 cuts to competitive wheel's 592, for 24% more wheel life.

Better performance
Connecticut machine tool manufacturer says R50 wheel outperformed competitive wheel, cutting freer on wet cutting of high carbon tool steel. (see photo)

120% longer life
Indiana construction equipment manufacturer reports R50 wheel produced 216 cuts, 120% more than competitive wheel's 98 cuts.

No burn or breakage
Kentucky manufacturer of garbage disposal units found R50 wheels eliminated the breakage problem and produced a cut free of burr and burn.

450 more cuts
Missouri manufacturer of coal mining equipment used an R50 wheel to cut 12 bars at 90 cuts per bar, totalling 1080 cuts. Beat best previous wheel's record of 7 bars, 630 cuts, by 70%.

Freer cutting, longer lasting
Massachusetts manufacturer of pneumatic tools reports R50 wheel 25% more durable while producing an equal quality of cut. Freer cutting, with less of usual rubber wheel odor.

25% more cuts
Connecticut machine manufacturer reports R50 wheel produced 25% more cuts than competitive wheels, with equal freeness and cleanness of cut.

The B9

72% more durable
Michigan engine manufacturer says B9 wheel produced 250 cuts over competition's 145, lasting 72% longer.

Lasted three times longer
Ohio metal working company reports B9 gave three times the service life of competitive wheel, with excellent cutting performance.

40% more cuts
Pennsylvania die manufacturer found B9 wheel outproduced competitive wheel by 40% giving 252 cuts as against 180.

36% production increase
Missouri metal company tells how B9 gave 75 cuts to competition's 50-55, proving 36% longer lasting.

Wheel life doubled
New York manufacturer cutting tubing and bars says B9 wheel with F sides lasted twice as long as previous wheel and cut a wide range of metals. (see photo)

150% over competition
Maryland metal working company says B9 wheel gave 125 cuts, topping competitive wheel's 50 cuts by 150%.

42% more cuts
Pennsylvania construction equipment manufacturer averaged 125 cuts with B9 wheel, 42% over competitive wheel's average of 88 cuts.

85% longer life
California forge and pipe foundry reports B9 lasted 85% longer than any other wheel.

27% more durable
Ohio aircraft manufacturer, cutting a wide variety of bar stock, says B9 wheel delivered 27% longer life than competitive wheels.

Performance reports like these are coming in every day, telling how the new Norton R50 and B9 cut-off wheels are setting new records for extra long service life and improved cutting action. Check them carefully, then judge for yourself how much your own cutting-off operations will benefit by these outstanding wheels. And remember: for every cut-off job you do, there's a Norton cut-off wheel that will add the money-saving "Touch of Gold".

See Your Norton Distributor for the cut-off wheels you need. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your classified phone directory. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

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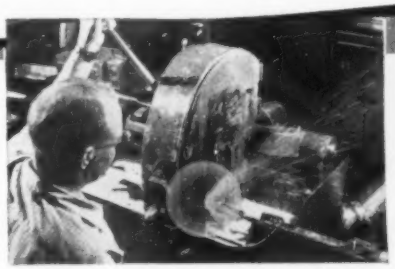
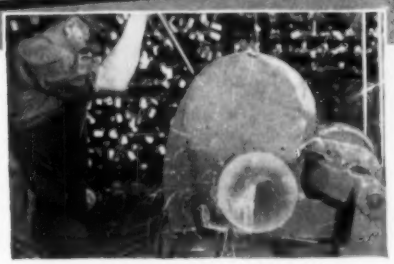


The New Norton R50 rubber bonded cut-off wheel is designed especially for wet cutting of ferrous or non-ferrous bar stock up to 6" diameter. Built-in chip clearance — a great advancement in this type of wheel — is one of its special "Touch of Gold" advantages that assure freer, faster cutting with maximum strength and service life.



The New Norton B9 resinoid bonded cut-off wheel is made with either smooth sides or with the rough "F" sides for more clearance in the cut. It is a high production wheel, cutting free and cool with minimum burning. It will give you long, economical "Touch of Gold" performance in the widest range of ferrous and non-ferrous applications. W-1570

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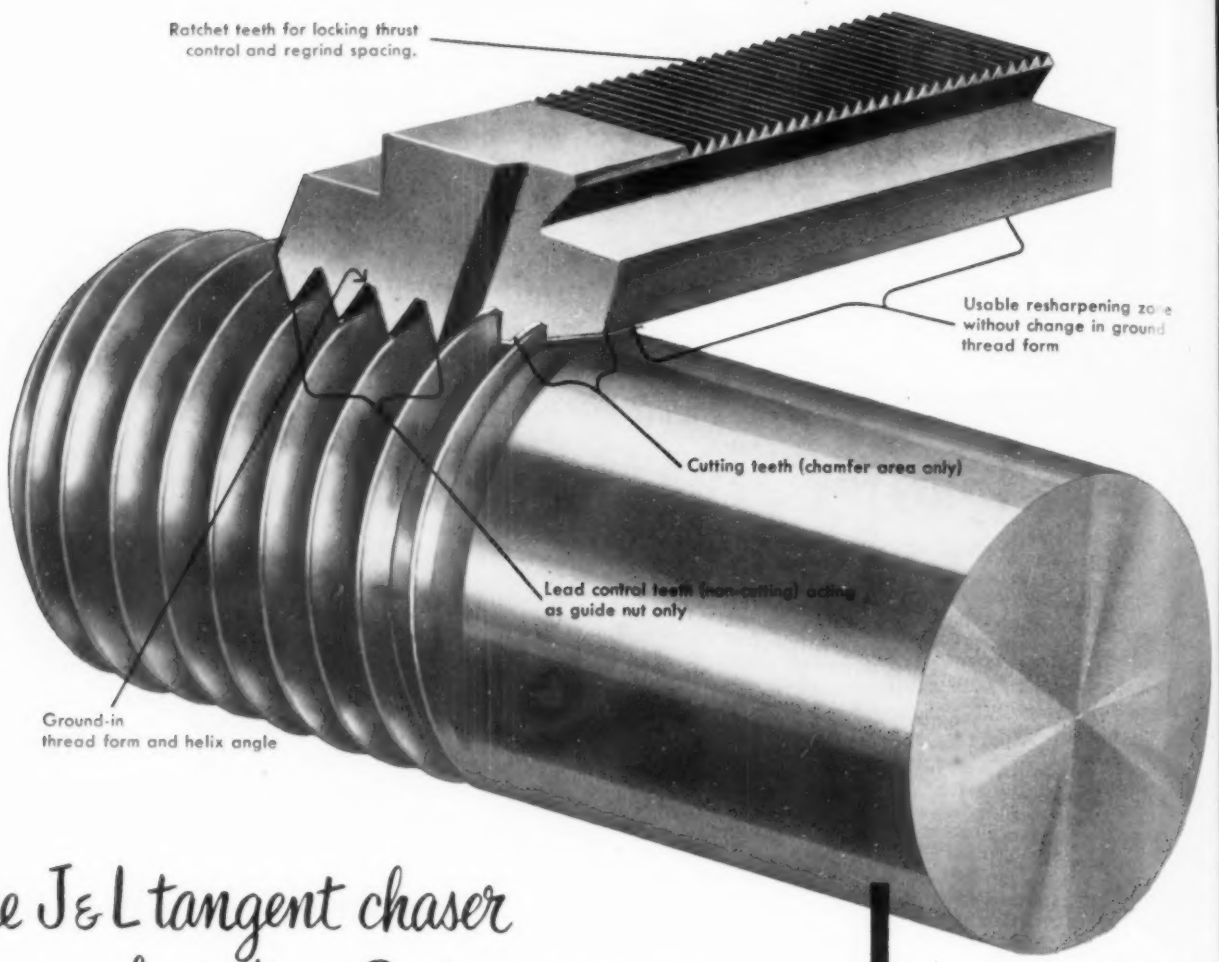
Ratchet teeth for locking thrust control and regrind spacing.
Usable resharpening zone without change in ground thread form
Cutting teeth (chamfer area only)
Lead control teeth (non-cutting) acting as guide nut only
Ground-in thread form and helix angle

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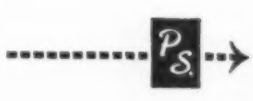
All four chasers in the set are positioned tangent to the work, making them cut like any other end cutting form tool. J&L tangent chasers have the thread form ground in at the exact helix angle for the size and pitch being threaded. Cutting action is confined to the chamfered area and the first full tooth in a set. The non-cutting teeth, purposely end ground above center, act as a precision lead nut. The non-cutting teeth on all four chasers act as a steady-rest and help control the lead with extreme accuracy. Class III guaranteed. *This means important savings regardless of your tolerance requirements.*



J&L Automatic Opening Die Heads and Chasers assure low initial cost — ease of operation — controlled resharpening — use of carbide where applicable. Class III threads guaranteed.

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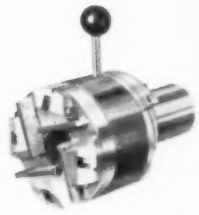

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Tangent Revolving Type
Capacities from #4 to 2"

Brown & Sharpe Types, capacities #0-1¼" — for #0 & #2 B&S machines & small turret lathes.

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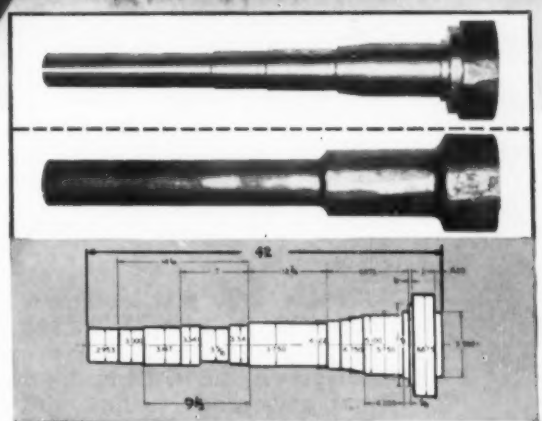
with the new Axelson Trace-o-Matic Hydraulic Tracer Attachment

The Trace-o-Matic attachment provides fast, automatic precision duplication from flat templates and is adaptable to all classes of work including contour turning, boring and facing. It takes full advantage of the ability of Axelson lathes to take heavy uninterrupted roughing cuts or fine finishing cuts to very close tolerances without the need of a highly skilled operator.

Many outstanding features are designed into the Trace-o-Matic which make it exceptionally economical to own and to operate. Only simple, inexpensive flat soft steel templates which serve for both roughing and finishing are required. Templates can be readily made in your own shop by turning in a bar holder or any other method. In addition, only simple single point tools are required and expensive form tools are completely eliminated. Set-ups require only minutes and after the machine is set to turn the first work diameter it is automatically set to produce all diameters and contours from the template. Small lots or large quantity production work can be handled with equal efficiency and economy.

Your turning costs can be greatly reduced and your production increased by installing a Trace-o-Matic on your present Axelson lathe or by ordering it on a new Axelson lathe. It will pay you to look into the matter without delay!

Write for Axelson's 16-page bulletin describing the New Axelson Trace-o-Matic attachment in detail, or call your nearby Axelson distributor. 6146 Boyle Street, Los Angeles 58, California



PERFORMANCE DATA

Part	MACHINE SPINDLE
Machine	Axelson 20" lathe with Trace-o-Matic attachment
Number of Pieces	6
Material	4820 Steel Forging
Hardness	180 Brinnell
Max. Depth of Cut	¾"
Greatest Precision	+.003"—.000"
Tool Material	Tungsten Carbide
Floor to Floor Time	64 Min. with Trace-o-Matic
Floor to Floor Time	129 Min. Former Method
Production Increase	200%

AXELSON MANUFACTURING COMPANY DIVISION
PRESSED STEEL CAR COMPANY, INC.
LOS ANGELES 58, CALIFORNIA

PSC

RAILROAD CARS • STANDARD PARTS • DAIRY & FARM EQUIPMENT • WASTE CONTAINERS • STAINLESS STEEL COOKWARE • CAR ACCESSORIES • TANKS • AGITATORS • SMOKE STACKS • DUST COLLECTORS • COAL & ASH HOPPERS • FITTINGS & ELECTRICAL HOUSING MATERIAL • UNITED TEE RELOCATABLE HOMES • EXPORT ONLY: LOCOMOTIVES & TRACKWORK • CARS: MINE, ORE, CANE, INSPECTION • UNISTRUT METAL FRAMING • WEED BURNERS • BRICK & TILE MACHINERY • CANE LOADERS

THEY WOULDN'T BELIEVE IT

—until they SAW it!

Seeing was believing for a group of mechanical officials from one of the mid-west's most prominent earth moving equipment builders.

Frankly they just wouldn't believe that the new 32" "AMERICAN" Pacemaker Lathe would effectively use 60 horse power and cemented carbide cutting tools in machining rough alloy steel forgings. So they came to see for themselves and they saw:

1. Cuts 1⅛" deep.
2. Cutting speed 300 feet per minute.
3. .030" feed.
4. 60 to 65 horse power registered by horse power meter during the maximum cuts.
5. Not a shimmy or whimper from the machine.

They were amazed and convinced.

This new model Pacemaker is endowed with the power, stamina and convenience that combine to produce a thoroughly dependable and highly productive unit.

Bulletin No. 44 tells all . . . have one?

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

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Get American's NEW CATALOGS for YOUR KING SIZE SELECTION

American's 3-D simplifies ordering drill jig bushings — eliminates confusing code numbers. No need to search through many pages — American's catalog shows all of their KING SIZE selection of ASA and American Standard types of sizes on two facing pages. (50% of your specials are now American's standards.) All you have to do is order 1—I.D.; 2—O.D.; 3—LENGTH.

Order American Drill Bushings the 3-D way . . . from our fully stocked distributors located in every major area throughout the U.S. You can get the right drill jig bushing when you want it!

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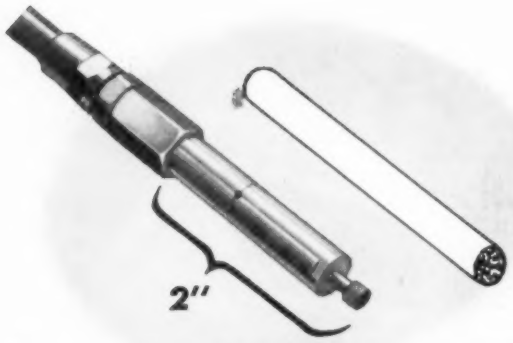
DRILL BUSHING CO.
5107 Pacific Blvd., Los Angeles 58, California

LOOK FOR THE TRADEMARK

SPECIALIZING ONLY IN DRILL JIG BUSHINGS!

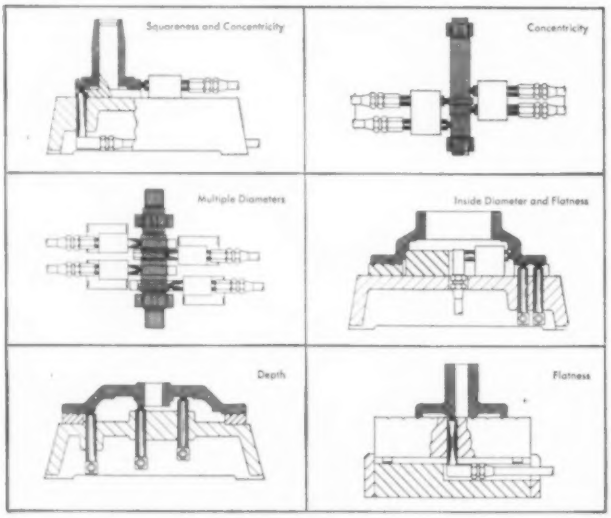
FEDERAL



AIRPROBE is smaller than a regular cigarette!

You Don't Need Any Masters to Calibrate the AIRPROBE

Some Jobs require Federal Special-Design Gages. Here's how the AIRPROBE is applied:



Federal's Model 165 Hole Gage equipped with a Federal AirProbe. Gage makes mechanical contact with the hole diameter.

4 EXCEPTIONAL FEATURES:

❶ self-zeroing

No tolerance setting masters required — simply set the AirProbe to zero on the Dimensionair scale and adjust in the gage as you would a Dial Indicator.

❷ accurately calibrated

All readings on the dial are actual calibrated readings — not arbitrary values divided between minimum and maximum limits as with other air gages.

❸ longer measuring range

A much longer range per magnification than that of other similar gage heads. Available ranges, with different dials, are .003", .006", .015", and .030".

❹ longer approach range and overtravel

With an approach travel of .031", a spindle travel of .140", and an overtravel of from .070" to .100", there's plenty of surplus for easy setting and measuring.

AIRPROBE !

Apply it directly to Federal Catalog Gages — No need to design Special Gages!!

The Federal AIRPROBE now makes it possible to gage by air a great variety of dimensions of almost any type, under almost any condition, when circumstances indicate that air can do the job best. It's a universal gage-head — a small, spindle-like device —which can be used in practically the same manner as a Dial Indicator on gaging fixtures, otherwise inaccessible locations, and on machine dimension control applications. Dimensional variations are read directly on the precisely calibrated dial of the Federal Dimensionair just as they are on a Dial Indicator.

Any production supervisor, engineer, or inspector, realizes that top efficiency lies in careful selection of the gage best suited to the requirements. Gaging with the DIMENSIONAIR AIRPROBE often offers certain advantages and enables him to meet his requirements with a greater degree of precision.

Federal offers practically all systems of gaging — air, dial indicators, electrical, and electronic. We design and make all these gages and can advise you *without bias* as to what system is best suited to your requirements. Ask our engineers for their recommendations. Federal Products Corporation, 4197 Eddy Street, Providence 1, R. I.

Ask **FEDERAL**

FOR ANYTHING IN MODERN GAGES . . .

DIAL INDICATING, AIR, ELECTRIC OR ELECTRONIC — FOR INSPECTING, MEASURING, SORTING OR MACHINE SIZE CONTROL.

A regular Federal Catalog Gage, Model 36 B-6 Bench Hole Gage, equipped with a Federal AirProbe and Dimensionair. Don't waste time designing special gages to use air when Federal already has *Catalog Gages* of proved designs.

The well known Federal NB-60 is shown here with a Federal AirProbe and Dimensionair. Another illustration of the economy of using Federal "already designed and built" gages with air.

measuring up

...and REX is the standard by which all high speed steels are compared

An older brother sometimes makes a handy yardstick for measuring junior's growth. And when it comes to tool steels, REX® High Speed Steel is — and has been for over 50 years — the standard of comparison.

There's no mystery to REX High Speed Steel. Its quality has been time-tested in thousands of shops. And after all, it's performance — not claims — that really counts. Make your *own* comparison test. Put REX High Speed Steel to work. Compare its structure, finish, hardenability, carbide distribution and general uniformity. You won't find another high speed steel that surpasses REX.

Remember, too, that even though it is widely distributed and used, REX High Speed Steel is made *only* by Crucible. So for tops in high speed steel performance, be sure you order the Crucible REX brand.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **TOOL STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N.

Tilts . . . to save you time!

The No. 2 Vertical Milling Machine with Swiveling Head and Spindle Power Feed (optional) allows you to mill, drill, bore, or die-sink at any angle . . . *accurately and easily*. Saves you time on many jobs that would otherwise require complicated set-ups. In addition, the spindle feed stops are designed for rapid and accurate step-milling—a big time-saver on production work requiring milling to several different depths. Available in two models, each having three advantageously placed driving motors—3 or 5 H.P. for the spindle, ¾ H.P. for the feeds, and ¼ H.P. for the coolant. Write for complete details.

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More For Your Money. . .
. . . Brown & Sharpe End Mills. You get more clean cuts per dollar invested with these quality end mills. Made to be the best you can buy, they give you real economy through highest quality. Therefore, when you order end mills, why not get the most for your money . . . choose from the complete line by Brown & Sharpe. Write for Catalog 35C.
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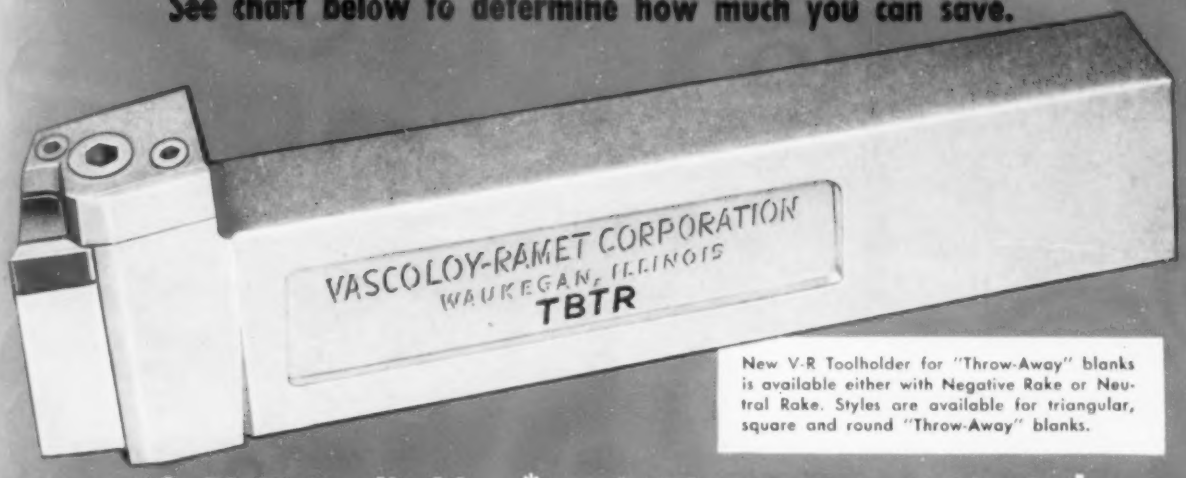
NOW Cut Your Carbide Tooling Costs in Half!

See chart below to determine how much you can save.



New V-R Toolholder for "Throw-Away" blanks is available either with Negative Rake or Neutral Rake. Styles are available for triangular, square and round "Throw-Away" blanks.

with V-R Toolholders* and "Throw-Away" Blanks!

- No Chipbreaker Grinding
- Lower Tool Inventory
- Available with Negative or Neutral Rake
- No Carbide Grinding
- Cutting Edge Automatically Positioned
- Another Cutting Edge Quickly Available

More Economical Than Brazed Tools

Compare The Cost Per Cutting Edge...

The costs on a brazed tool's useable cutting edges are:

1. Original cost of the tool
2. cost of each regrind
3. Number of regrinds obtainable

Formula for computing cost per cutting edge

$$\frac{\text{(Cost of Tool)} + \text{(No. of regrinds} \times \text{cost per grind)}}{\text{Number of regrinds} + 1 \text{ (for original tool)}} = \text{Cost per cutting edge}$$

V-R "Throw-Away" Blank Cost Per Cutting Edge

"Throw-Away" Blank Style and Size	Triangular				Square		Round	
	1/4"IC	3/8"IC	1/2"IC	5/8"IC	3/8"sq	1/2"sq	3/8"	1/2"
Utility Class for NEGATIVE RAKE Type	.06	.10	.20	.33	.07	.15		
UTILITY Class for NEUTRAL RAKE Type	.12	.20	.40	.66	.15	.30		
PRECISION Class for NEGATIVE RAKE Type	.10	.17	.27	.42	.13	.23	.06	.11
PRECISION Class for NEUTRAL RAKE Type	.20	.34	.54	.84	.27	.47	.16	.26

Compute the cost per cutting edge for a typical brazed tool you use and compare it with cost per cutting edge of a "Throw-Away" blank!

V-R Toolholders are also available for holding triangular, square and round inserts up to 1½" long. See Toolholder Catalog VR-435.

Write Today for New Toolholder Catalog and Price List VR-436

Vascoloy-Ramet CORPORATION

Since 1933 — Makers of

THE WORLD'S FINEST CARBIDE

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*Patent Pending

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25 Years of Progress

Pictured here is the home and products of

PARKER-MAJESTIC, INC.

Established in 1929, this company has for 25 years manufactured the **Parker** Spindles used in Precision Grinding, Boring and Milling applications. Additional products include the well known line of **Parker-Majestic** Internal, External, No. 2 Surface and Rotary Surface Grinders.

Descriptive literature upon request.

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look . . .

any one of these 24 punches and dies

READY FOR USE IN 5 SECONDS

without set-up!

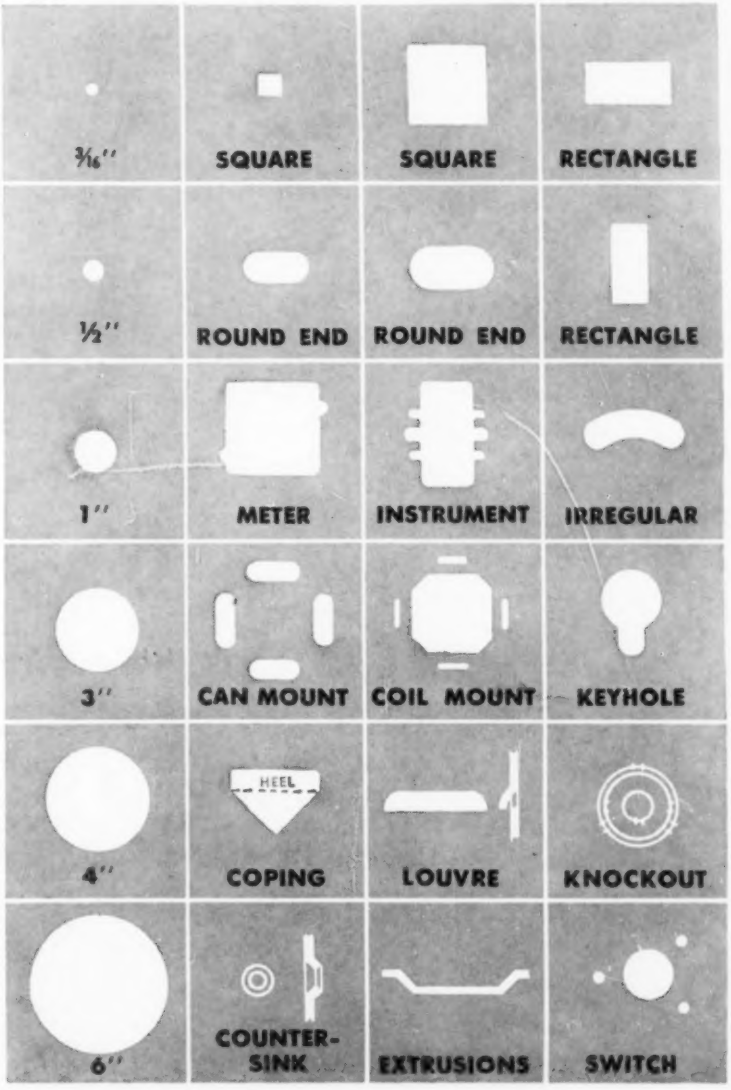
- Or, any selection of 12 to 32 punches and dies suited for your work.
- A Wiedemann Turret Punch Press has the tools where you want them—in the press—not on the shelf.
- In 5 seconds the operator selects the punch and die, and pierces the opening in flat sheet metal or plate.
- Any punch and die in the turret can be replaced with other sizes in less than 2 minutes.

WITH A WIEDEMANN YOU CAN SAVE 60% TO 90% ON SMALL LOT PIERCING because you

Eliminate Set-up
Eliminate Layout with Wiedemann Work Locating Gauges
Reduce Handling Time

We will make time studies on your work without obligation. Send prints.

Plan view of lower turret of typical Wiedemann with 18 stations.



WIEDEMANN MACHINE COMPANY

4245 Wissahickon Ave., Philadelphia 32, Pa.

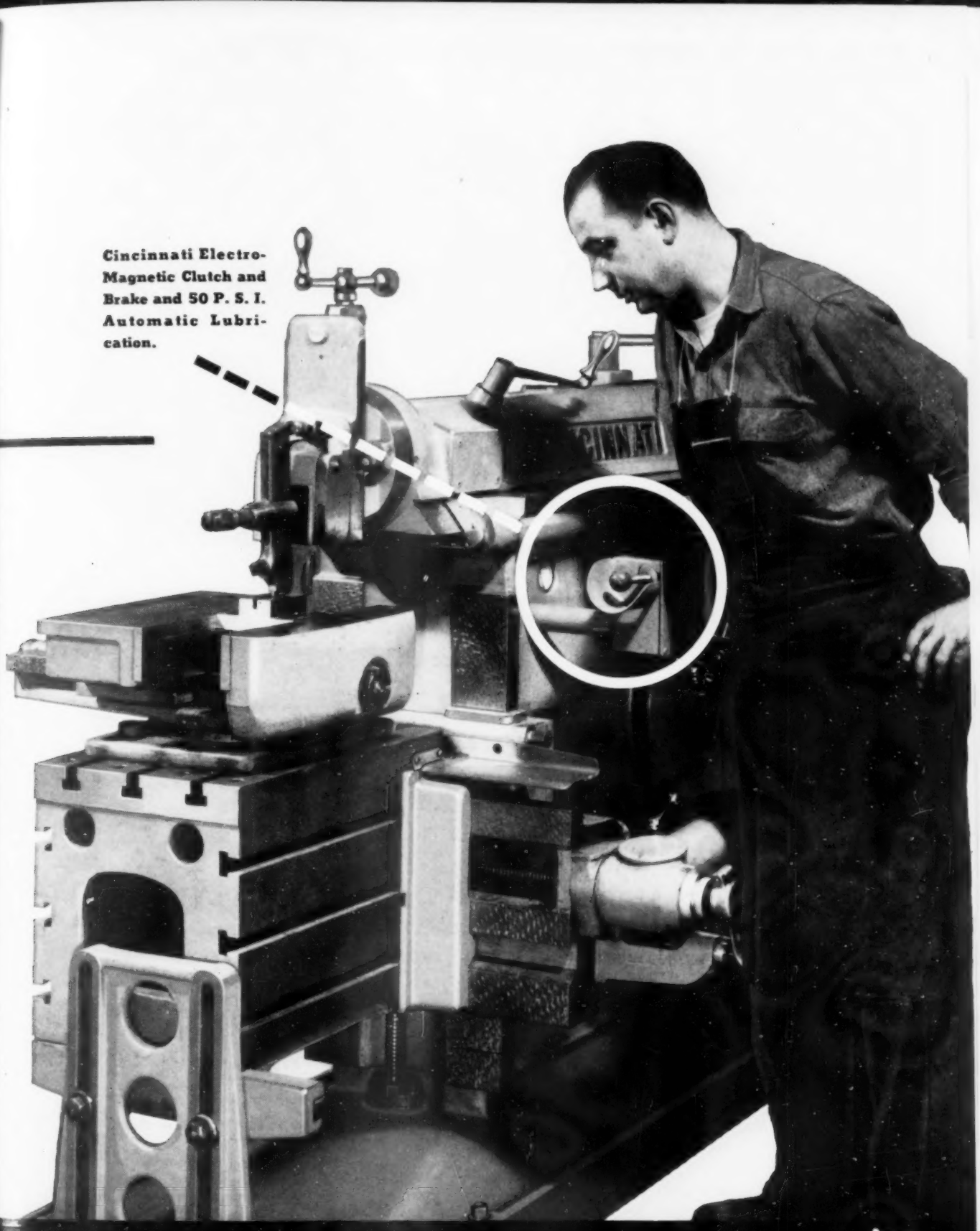
toolmakers prefer this CINCINNATI shaper

17 cubic foot Revco, one of many Food Freezer models built by Revco, Inc., Deerfield, Michigan.

Revco, Inc., producers of Food Freezers, state their toolmakers prefer using this 20" H. D. Cincinnati Shaper. They like the convenience of all controls located at the operator's position and the amazing speed of the electro-magnetic clutch and brake. They like the assurance provided by the 50 P.S.I. automatic lubrication. They like the very high accuracy obtained in shaping jigs and fixtures, drawing, forming and blanking dies.

Write for the new illustrated catalog N-6 on Cincinnati Shapers.

Photo courtesy Revco, Inc., Deerfield, Michigan



THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

you can
SAVE TIME
and
MONEY
on
jobs like this
with
the

...GISHOLT SPEED SELECTOR!

HERE'S WHY:

No manual gear shifting! You simply turn this hand wheel or touch a trip lever (for Direct or Pre-set operation). Shifting is automatic—by hydraulic power—while the operator positions the new tools for the next cut.

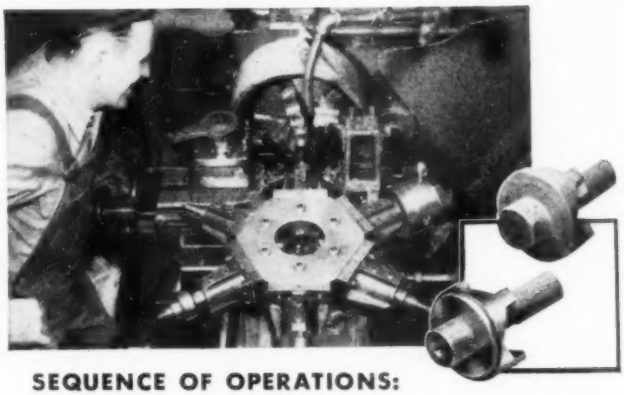
It's all so much simpler with the Speed Selector. There's no need for time-wasting computations, no mental effort, no physical effort. With simple controls, either direct or prearranged, the operator gets the ideal f.p.m. cutting speed for each cut. And it's *much faster,* of course!

The Speed Selector is standard on Gisholt Nos. 4 and 5 Ram Type Turret Lathes and on all Gisholt Saddle Type Lathes.

GISHOLT
MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

HERE'S HOW:



SEQUENCE OF OPERATIONS:

Note the star which indicates each time the Speed Selector is used.

★ **1. Hexagon turret—Center drill at 297 r.p.m. hand feed**

2. Hexagon turret—Support with live center

★ **3. Square turret—Rough turn and face at 96 r.p.m., .003 feed**

★ **4. Square turret—Finish turn, face and chamfer at 126 r.p.m. .002 feed**

★ **5. Hexagon turret—Start and drill through at 226 r.p.m., .003 feed. Trip the Hi-Lo lever, eliminating even the need for turning the hand wheel**

★ **6. Hexagon turret—Thread with tap at 39 r.p.m., leaders and followers**

—and you're ready for a new workpiece

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Another

Starrett®

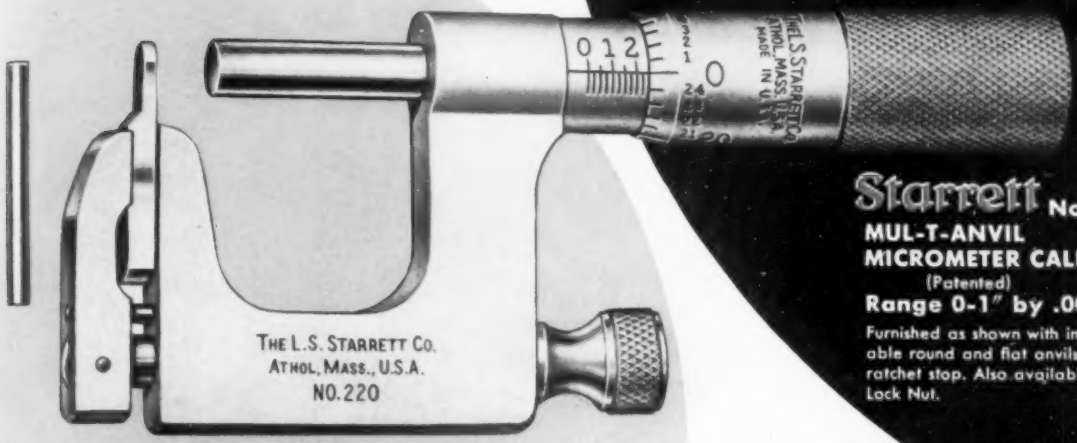
first!

NEW No. 220

MUL-T-ANVIL

MICROMETER CALIPER

(Patented)



Starrett No. 220
MUL-T-ANVIL
MICROMETER CALIPER
(Patented)
Range 0-1" by .001"
Furnished as shown with interchangeable round and flat anvils, without ratchet stop. Also available with Lock Nut.

REDUCES TOOL INVESTMENT

ONE MICROMETER FOR MANY USES

MEASURES WHERE OTHER MIKES WON'T

USE WITH STANDARD OR SPECIAL ANVILS

ANVILS CHANGED QUICKLY, LOCKED RIGIDLY

ONLY ONE SIMPLE LOCK SCREW ADJUSTMENT

Easy THROUGH YOUR **INDUSTRIAL DISTRIBUTOR**
Prompt delivery
Dependable service
Quality products

Here is a brand new development in micrometer design . . . a micrometer with multiple interchangeable anvils created with typical Starrett ingenuity to make easy work of a wide variety of difficult measuring jobs. It permits quick, accurate measuring of tubing, cylindrical walls or work of irregular shape . . . from holes or slots to an edge . . . in places difficult or impossible to reach with an ordinary micrometer. Can also be used as height gage.

New Starrett No. 220 *MUL-T-ANVIL* Micrometer is now available as a 0 to 1 inch micrometer caliper. Ask your industrial distributor to show you this indispensable new tool . . . or write for complete information. Address Dept. E

New Starrett No. 220 *MUL-T-ANVIL* Micrometer is furnished with two multi-purpose anvils, a round anvil and a double-ended flat anvil. It will also accept special anvils up to 5/16" thick — make your own at low cost or we will make them for you on special order. Anvils are rigidly held in a vise-type frame and quickly interchanged by a single lock screw adjustment.

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"WORLD'S GREATEST TOOLMAKERS"

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS · DIAL INDICATORS · STEEL TAPES
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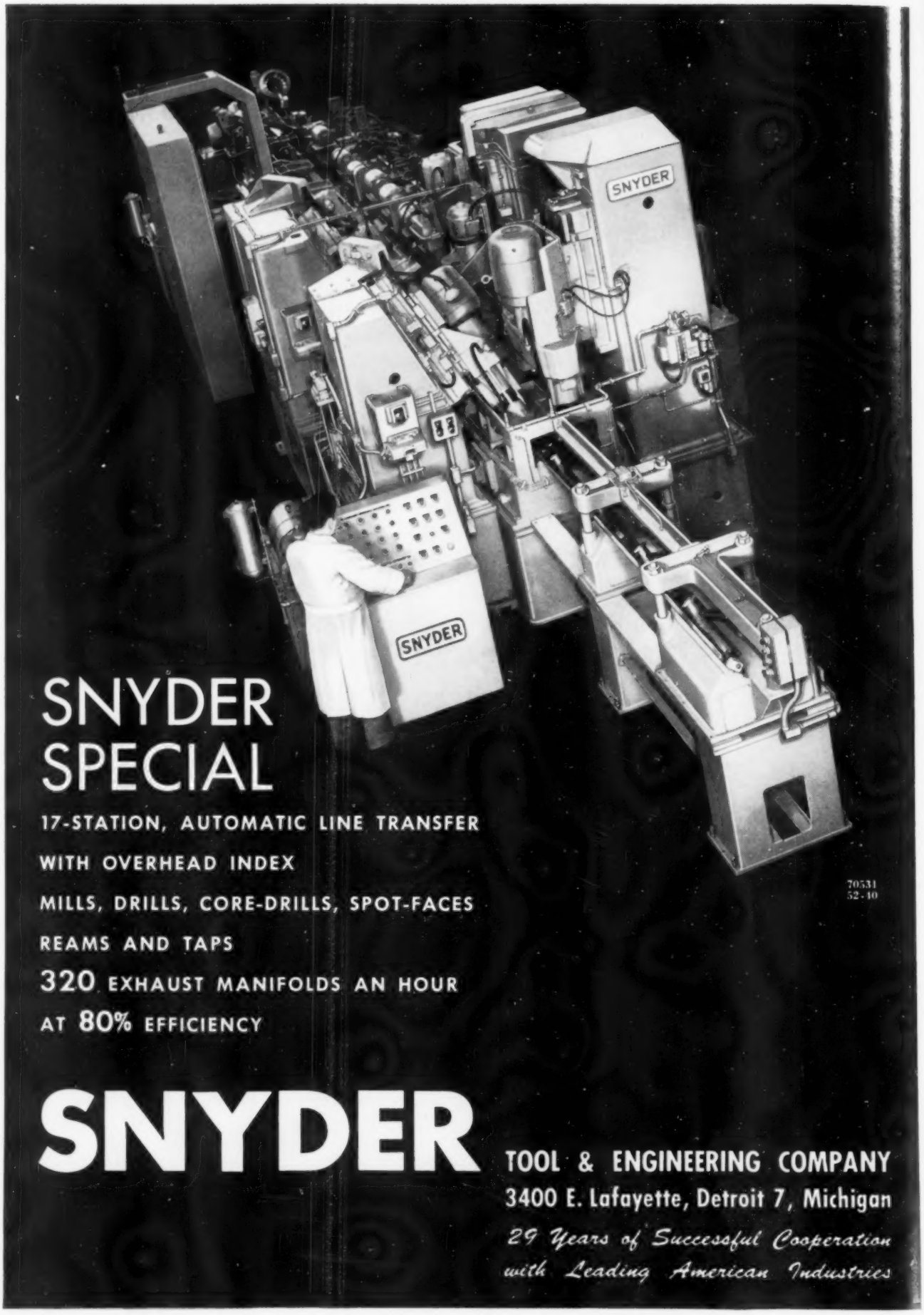
THE L. S. STARRETT COMPANY, ATHOL, MASSACHUSETTS, U. S. A.



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17-STATION, AUTOMATIC LINE TRANSFER
WITH OVERHEAD INDEX
MILLS, DRILLS, CORE-DRILLS, SPOT-FACES
REAMS AND TAPS
320 EXHAUST MANIFOLDS AN HOUR
AT 80% EFFICIENCY

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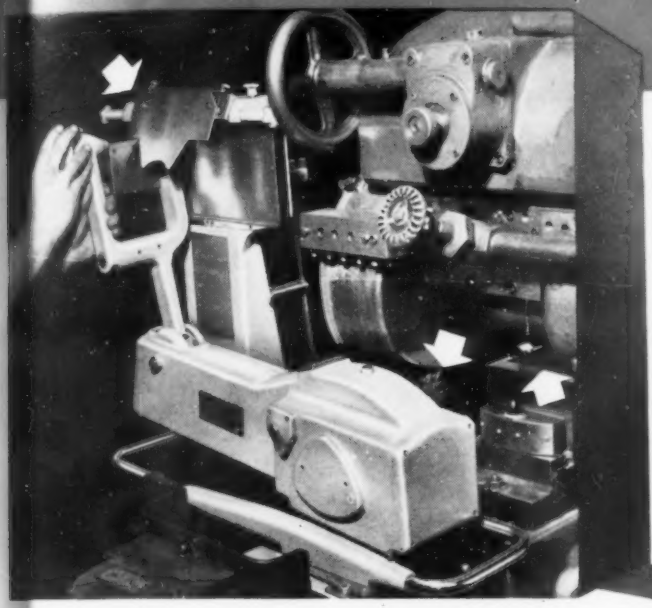
RELIEF GRIND FORMED CUTTING TOOLS

QUICKLY • EASILY • ECONOMICALLY without Lengthy Calculations

THE REVOLUTIONARY NEW PRATT & WHITNEY

Relief Angle Compensating



Diaform

WHEEL FORMING ATTACHMENT

Here is the most important advance in the making of formed cutting tools in nearly a century! This new model DIAFORM Wheel Forming Attachment is equipped with the unique Relief Angle Compensator that works from a simple, **true-to-form** template to provide complete, accurate compensation for all front and side relief and top rake angles normally required . . . even when cutting aluminum alloys, plastics, wood etc. Lengthy calculations, trial-and-error, projection drawings and distorted templates are eliminated; important savings in time and effort are realized.

Operation is simple. The template (prepared to the **exact** contours and dimensions of the finished product multiplied 5X or 10X) is mounted on the carrier. This assembly, which is equipped with graduated scales, is tilted to the included angle of both the front relief and the top rake; for side relief, the carrier is swiveled to the desired angle. The operator has now only to follow the template with the tracer bar using the guide knob, and the truing diamonds form the grinding wheel accurate to "tenths" and correctly compensated.

TAKE ADVANTAGE OF THIS NEW SCIENCE IN CUTTER RELIEF GRINDING . . . SEND NOW FOR COMPLETE INFORMATION — **Just fill in and mail the attached coupon . . . or write on your Company letterhead.**

PRATT & WHITNEY

DIVISION NILES-BEMENT-POND COMPANY

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BRANCHES IN PRINCIPAL CITIES

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PRATT & WHITNEY — Div. Niles-Bement-Pond Co.

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Gentlemen: Please mail my free copy of Circular No. 574 that gives complete data on the new P&W Relief Angle Compensating DIAFORM.

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The five Morse warehouses are linked together with the Morse plant in a complete teletype network, coast to coast. And this instant, constant communication means that your Morse-Franchised Distributor is able to give you top-speed service no matter what your cutting-tool needs may be at any moment . . . and no matter whether the particular tools you need are available right at that moment at any single stock-point. He knows how to find them fast, and get them to you "quickest way". And that goes for the complete line of the finest cutting tools made . . . Morse Drills, Taps, Dies, Reamers, End Mills, Counterbores and Milling Cutters. *So always call your Morse-Franchised Distributor.*

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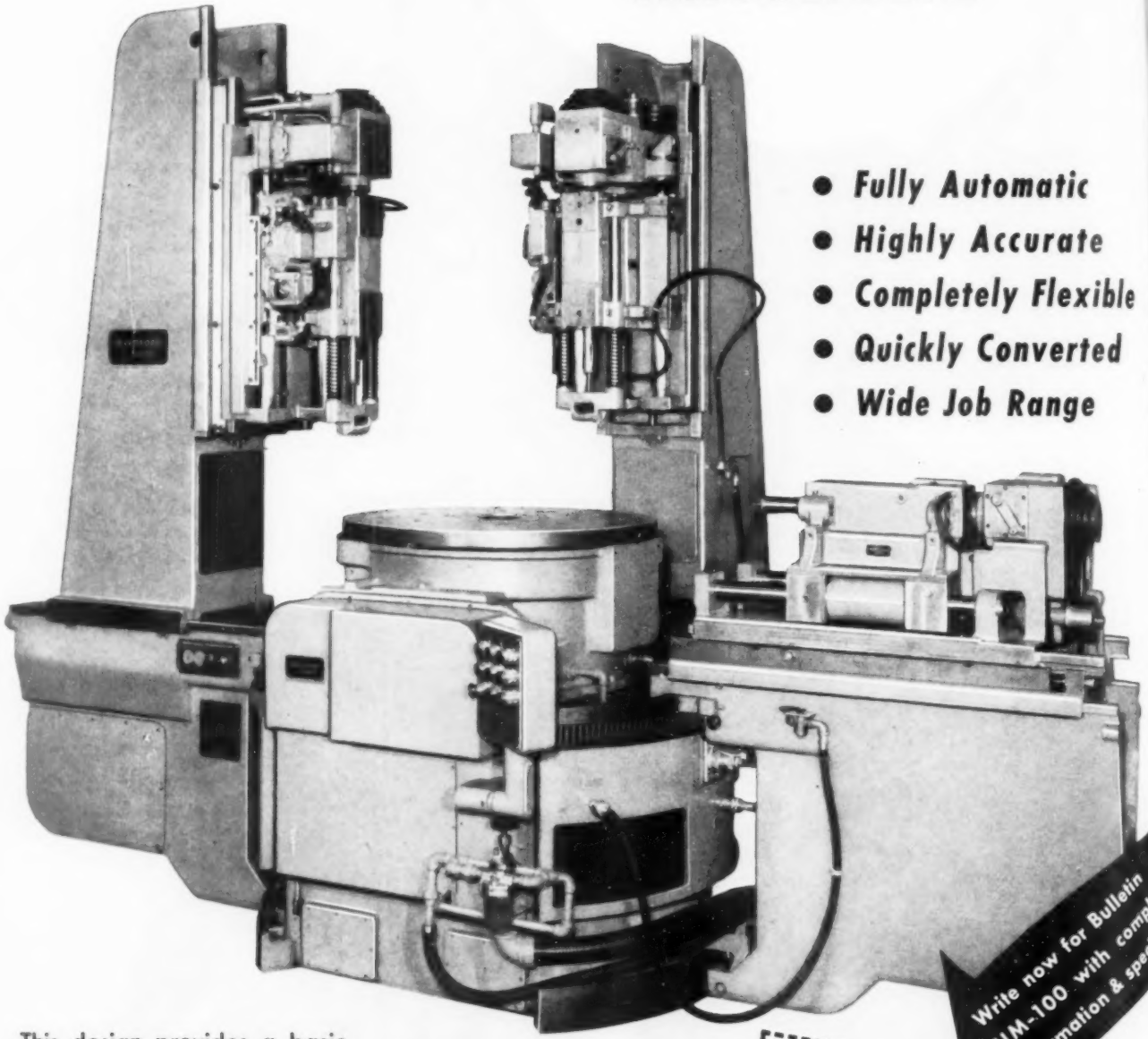
Cutting Tools

Buy them by phone from your Morse-Franchised Distributor and save ordering time

HARTFORD *Special*

UNIVERSAL DRILLING MACHINE



- *Fully Automatic*
- *Highly Accurate*
- *Completely Flexible*
- *Quickly Converted*
- *Wide Job Range*

Write now for Bulletin UM-100 with complete information & specifications

This design provides a basic machine employing standardized component assemblies with utmost versatility. It enables the user to create his own single purpose machine to keep pace with engineering changes and obsolescence of parts. Yet it requires only one original investment.

QUICK SPECS:

1. Handles 8" to 60" diameter bolt circles.
2. Accommodates up to four drilling or tapping units.
3. Has 16 spindle speeds from 180 to 6700 RPM.
4. Interchangeable index plates for equal or unequal hole patterns.
5. Has ½" capacity in stainless steel.
6. Units quickly adjustable radially, vertically and circumferentially.

The Hartford Special Machinery Co.
Hartford 12, Conn.

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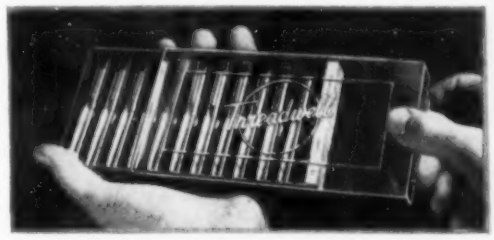
A-1



NEW PLASTIC TAP BOXES

COMPLETE LINE OF STANDARD & SPECIAL TAPS

PROTECTED QUALITY

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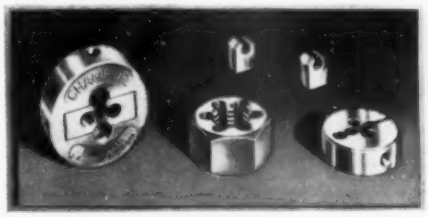

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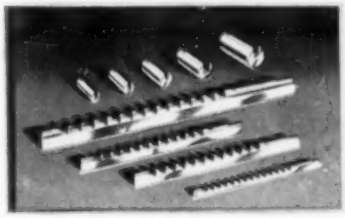

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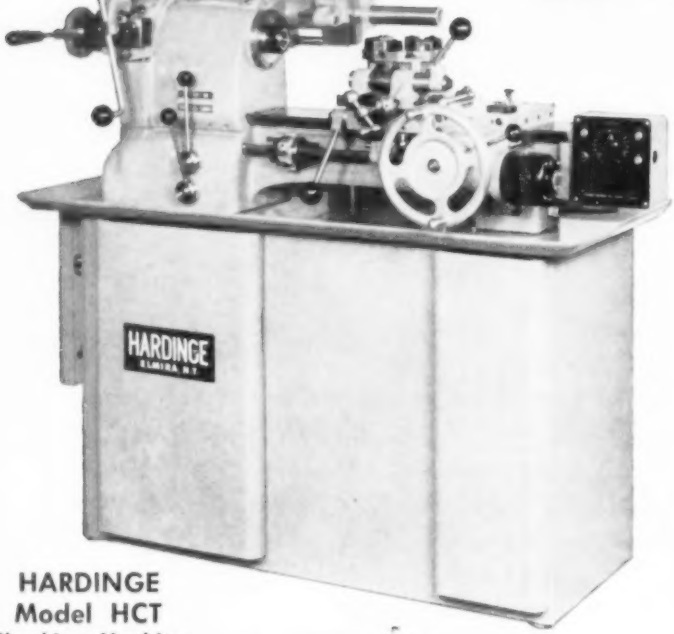

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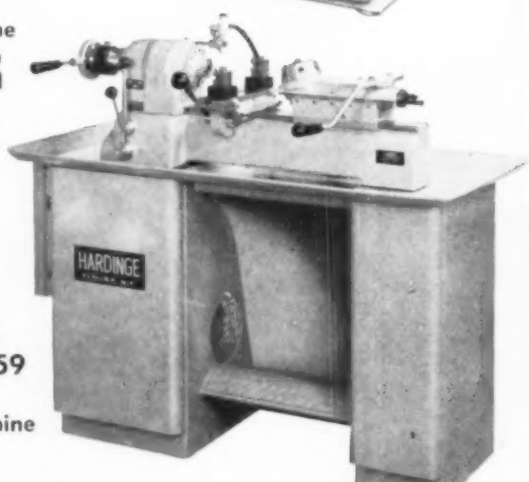

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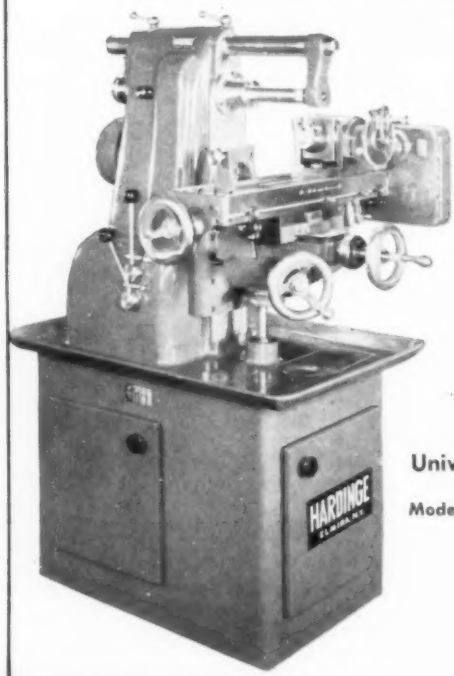

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The Tool Engineer

Learn and Share

One of the most significant things about our Society is the seriousness of purpose of its members. This was never demonstrated so clearly as it was at the 22nd Annual Meeting in Philadelphia last April. There were thirty technical sessions conducted by our National Program Committee from Monday to Friday morning, afternoon and evening. The attendance at these meetings amounted to 6,249, an average of 200 at each meeting.

In addition to this, the Carbide Seminar conducted by the University of Pennsylvania, and our National Education Committee, registered 220 for a course of five mornings during the Show week.

The aim of our Society in improving the technical knowledge of its members was never so clearly appreciated. The tool engineer of today wants to be the man with the production know-how. He goes out of his way not only to obtain this knowledge, but to explain it to his fellow member. This dissemination of technical knowledge is our primary objective.

We have just chartered our 117th chapter. Our membership has grown to almost 30,000. Yes, we have come a long way from the original twenty-one Charter Members who held their first meeting in Detroit twenty-three years ago. In almost every chapter eight out of every ten meetings held during the year are on tool engineering subjects. In addition, many of out chapters hold student courses in tool engineering. The interesting point is the desire in our membership to satisfy their thirst for technical knowledge.

During the summer months the fraternal side of our Society comes to the front. The annual outings, clambakes and golf tournaments held by our various chapters give us all a chance to work off some excess energy. You can be sure that your Executive Committee will work all through July and August making plans for the programs next fall and winter.

It is no wonder that our Society is the fastest growing technical society in the Western Hemisphere.

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correcting

carbide tool troubles

By David C. Kauffman*

Production Manager
Cavitron Equipment Corp.
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Tool control needed to maintain machine productivity has many phases. Correction of tool troubles is one of the most important because it is least understood and relies more on experience than on general rules. Correction of tool difficulties often requires trial-and-error checking to eliminate possible causes, until a cure is effected.

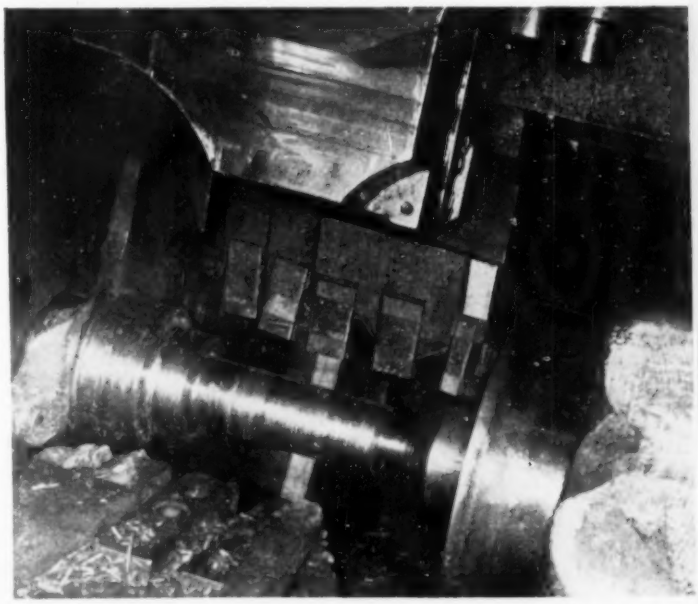
WITH THE HIGH PRODUCTION RATES demanded of today's machine tools comes a heavy burden for the tool supervisor or tool trouble man. Machine tools have been improved so that relatively little mechanical trouble develops but there still exists the problem of preventing or quickly correcting tooling troubles. Tool troubles result from the complexity and multiplicity of cutting tools, *Fig.* 1, and the new philosophy behind machine tool use. More and more emphasis is placed on performing multiple cutting operations on a workpiece in a single machine. As many as 50 tools may operate in one machine. One tool down can result in 49 other tools and the machine being idle.

Even relatively simple machines performing only a few operations can have tooling problems because their productivity has been stepped up substantially. Feeds, speeds and depths of cuts have been greatly increased in the last few years. Great progress has been made in metal-cutting machine tool development but little improvement or progress has been made on the cutting tool.

The machine tool can be compared to a large inverted pyramid: the more complex the machine, the larger the pyramid. The support of this machine pyramid is the cutting tool point engaged in the workpiece. It is paradoxical while the cutting tools usually cost just a few dollars apiece, they often fail to receive attention in proportion to their total cost.

General Procedure: When a machine is having tool troubles, the first step in the diagnosis is to carefully examine the tool. It should be compared to blueprint specifications to determine that it is of the correct material and shape. Such examination may reveal deviations in relief or rake angles, chip breaker or other specification.

Fig. 1. Multiple tool setup typical of production machining operations in many industries. In addition to the two gangs of tools visible a third has retracted out of sight in the rear.



*Senior member ASTE Detroit chapter.

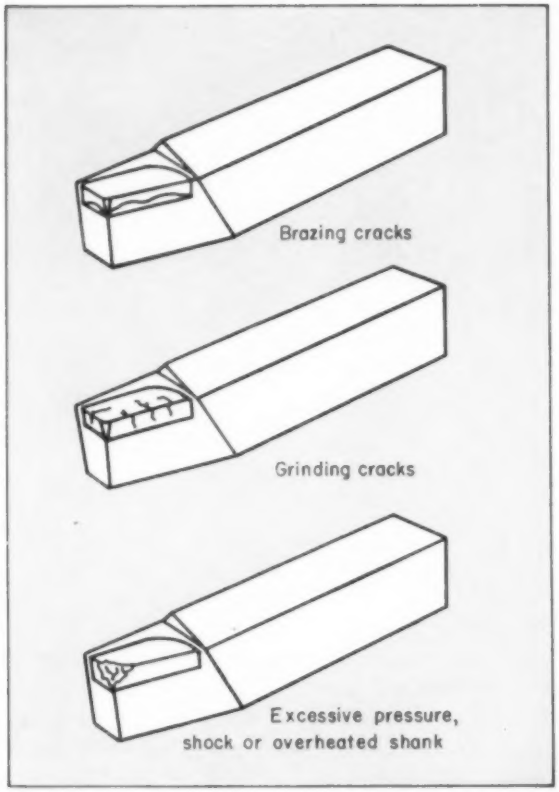


Fig. 2. (upper left) Examples of typical broken or cracked tools associated with specific problems.

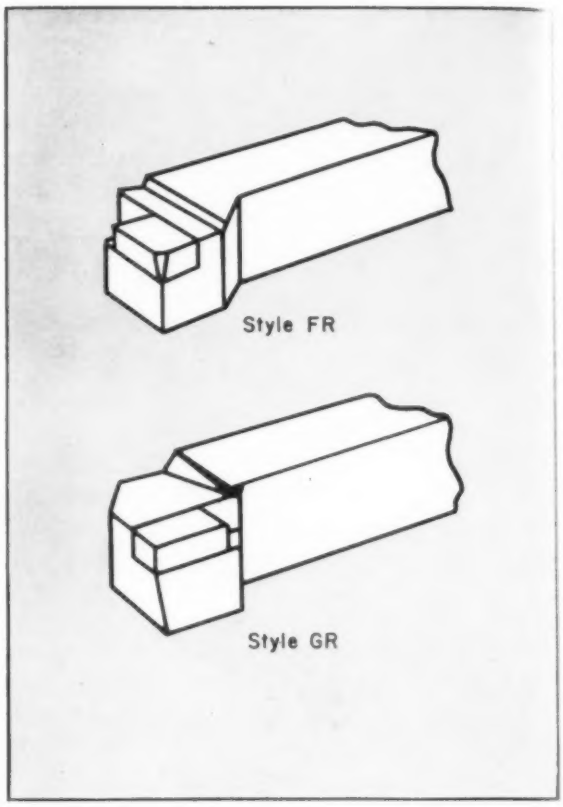


Fig. 3. (upper right) Slash milled tools permit freer movement of carbide, thereby relieving brazing and grinding strains and expansion during cutting.

If the tool is found to conform to print, the trouble may be traceable to conditions outside the tool. These might include improper or weakened tool holding devices, worn setscrews, bent or pitted shanks, or even an incorrect previous machining operation. Material specifications of the workpiece may have been changed from the time the machine was originally tooled and the present work may require different feeds and speeds.

Because of the complexity of many machining processes, the tool trouble shooter is often reluctant to pursue determination of proper feeds and speeds, since this may involve multiple problems. Such machines are usually set for predetermined feeds and speeds before delivery to the plant so that a major operation may be required to make changes. Thus, even though mechinability research has indicated that proper feeds and speeds are major factors in tool life and machine productivity, often everything else is examined first. As a result many tooling problems and troubles, especially excessive tool usage, are accepted as normal operating conditions and high tool costs burden production departments unduly. On the other hand, unauthorized changes in feeds, speeds or coolants are detrimental to tool performance. This is more likely to occur when there is more than one shift.

When tool troubles are investigated, a pattern of recurring troubles should be sought. It may be that certain operators, batches of work, shifts or groups of tools may be the cause. If this is indicated, then detection and correction is made easier.

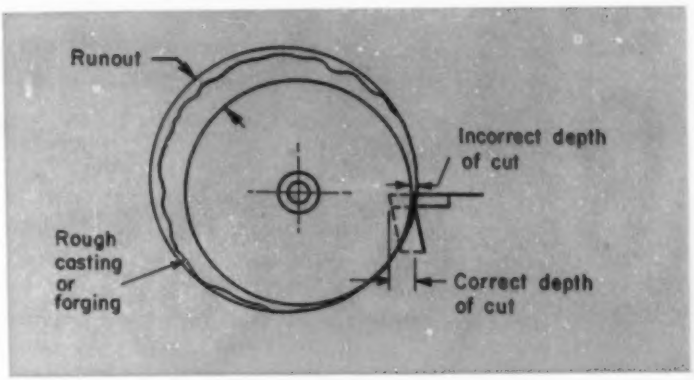
Often, several factors contribute simultaneously to faulty operation. To isolate specific causes, only one change at a time should be made. While it may apparently save time to change three or four things at once, the factor or factors at the root of the trouble are more difficult to find. Also, two or three unnecessary changes may be made which can affect ultimate tool or production costs adversely.

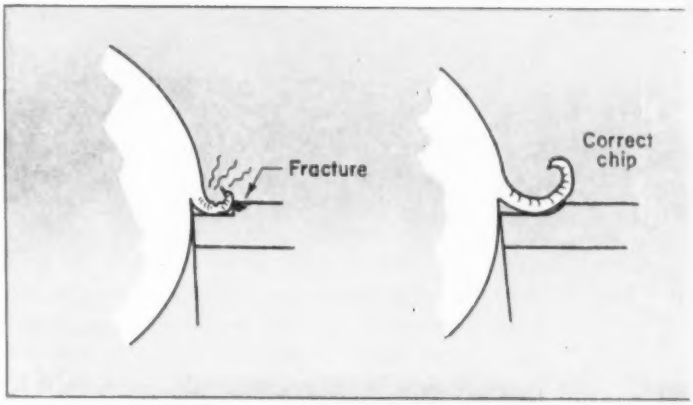
Once a tool or cutter has been repaired or replaced and is under close observation, the following procedure should be used. Upon completion of the first pass or cut, or after the first 30 to 60 seconds of operation, the machine should be stopped and the cutting edges of the tool examined with at least a 10X glass. The edge should be inspected carefully for minute chipping or flaking and evidence of rapid wear. This examination of the tool should be repeated many times during the first half-hour of operation. This is one of the best means of isolating the causes of the difficulty and discovering when and where it occurs.

If outside service engineers are called on for assistance, the vendor who supplied the tools should be the first called. An effort at correction or rework of existing tools is strongly recommended

Fig. 4. (right) Eccentric workpiece requires sufficient depth of cut to avoid shock of intermittent cutting and wear of cutting scale on surface.

Fig. 5. (lower right) Narrow chipbreaker (left) builds up excessive pressure and heat at the cutting tool tip.





before consideration is given to purchase of new tools or tool materials. The latter course is apt to be costly and time consuming because it may result in scrapping tools on hand without giving positive correction. In fact, snap judgment should be avoided and careful investigation relied on to reveal the basic cause of the trouble. Such action will result in permanent correction and indicate preventive measures to take care for other similar operations. Although specific recommendations for carbide turning tools are listed many of these techniques are also applicable to other types of tools.

Because of the severe conditions under which carbide tools operate, as well as the nature of the material, they are likely to be subject to more, and a greater variety of, troubles than other tools. The most common troubles occurring with carbide tools are: breaking, chipping, burning, cratering, rubbing and excessive wear. Other difficulties often encountered are rough finish on workpiece and chip clogging. Some of the more common causes of these problems are found in tool design, grinding, feed and speed, depth of cut, setup, chipbreaker, tool or workholders, tool condition, carbide grade, coolant and work material.

Tool Breakage: This is one of the major problems with single point tools. Faulty brazing and improper tip pocket design are the major causes. Usually, tools are broken in an area around the cutting point, *Fig.* 2. If the break occurs at a distance from the point equal to the depth of cut, it may be due to excessive wear on the cutting edge from scale which cause excessive localized heat. Rectangular breaks with one side at right angles to the side with the cutting edge are indicative of brazing strain cracks or cracks from faulty grinding. These cause the tool to give way when it is subjected to cutting pressure. Breaks around the end of the tool, or those which cover most of the top of the carbide but leave a thin surface of carbide, are evidence of brazing strains.

Breakage of the tool may be caused by too small a nose radius, which is likely to burn or fail when subjected to pressure since it lacks adequate support. The remedy is to use a large radius to add strength to the cutting edge. Again, the lead angle may be too wide, causing excessive pressure against the tool point, or it may be too small, causing the tool to be weak. If breakage occurs near the cutting point, the rake and relief angles should be reduced. If the break occurs toward the back of the carbide, it may be due to excessive pressure on the tool bit and increasing rake angles may be in order. Use of slash milled tools, *Fig.* 3, is another means of reducing breakage. On tools for heavy cuts, consideration must be given the design of the slash mill to avoid weakening the tool and causing excessive deflection under load if the shank is small.

Insert type toolholders should be used where practical because they are stronger and less prone to breakage. Harder grades of carbide can usually be used; the insert holders are usually made sturdier and of larger cross sections than brazed tools and, since the carbide inserts are held mechanically, larger pieces of carbide can be employed so they are stronger and better able to cope with shock and abuse.

When grinding is suspected as the cause of breaks, the tool should be examined for cracks before and after use. A 20X microscope is best for this. The reground tools should be checked before use for size, shape and conformance to blueprint dimensions. Tool grinding practices should be observed to see if tools are abused during grinding. Improper grinding, as well as poor brazing, can stress carbide tools near their elastic limit. Then, when the tools are put in operation, normal cutting pressures raise the stress above the elastic limit and a broken tool results. Another means of determining if grinding is at fault is to check the performance of reground tools against new tools. Some-

times in regrinding, excessive amounts of steel are ground away, leaving excessive and unnecessary clearance or tip overhang, which tends to weaken the tool.

Too slow a speed or excessive depth of cut will often cause broken tools. Since the depth of cut varies appreciably on workpieces such as forgings and castings, due to runout, *Fig.* 4, the sudden shock or vibration resulting may cause tool breakage. Where possible, tools should be designed for added strength by making them bigger and heavier, and reducing overhang. The amount of stock being removed by roughing and finishing tools on the same machine should be balanced so that minimum load is imposed on each tool. Also, it may be possible to add more tools to the operation at the critical position on the machine or at previous machining operations.

Chatter indicates lack of rigidity in the setup, an obvious cause of tool breakage which is readily corrected. The difficulty may be excessive overhang of the tool. Setscrews should be examined for wear and replaced if necessary. Center holes may be improperly located resulting in runout, and larger centers and heavier tailstock pressures may be necessary to improve rigidity.

Bent, burred or dirty toolholders may also cause difficulty. It should be determined that the shank is flat and properly seated in the toolholder. Hold-down screws should be flat bottomed and square with the axis of the screw. When tool shanks are soft and brinell, a hard shim should be used between the bottom of the screw and the shank.

Too narrow a chipbreaker may cause excessive pressure on the tool and be the source of breakage. In this instance a wider and shallower chipbreaker will prevent too tight chip curls, *Fig.* 5. Chips should be as open and large as possible, denoting minimum chip deformation, yet be readily disposable. When a chipbreaker is being developed, the depth should be reduced and width increased until optimum size chips result. A fillet should be provided at the shoulder of the breaker.

The shims in brazed tools may be the cause of breakage. Too thick shims will mushroom, due to cutting pressure, deflecting the end of the carbide tip and causing it to break. A thinner shim or none at all should be tried. Shims should be used with hard grades of carbide. Tri-metal type shims should be examined carefully as sometimes the silver does not adhere properly, causing an oxidized surface after brazing and leaving the tool weak. The shank may be of improper material also. Steel of 1095-1065 grade has been found superior to cold-rolled low-carbon steel for shanks. Hardened shank will not improve ability tof the tool to resist deflection but will reduce brinelling and loosening under hold-down screws.

When tools consistently break, a softer or tougher grade of carbide should be tried. Solid carbide tools are stronger than tipped tools and may be tried where applicable. The difficulty may also be improper or overly hard work materials not in accord with purchase specifications or workpieces with hard spots and inclusions.

Intermittent splashing of coolant on the hot tool may be the cause of breakage. Chips, fixtures and tooling in general should be examined to locate interference with the coolant. It may also be that the pump is worn or operating improperly, giving low pumping pressure.

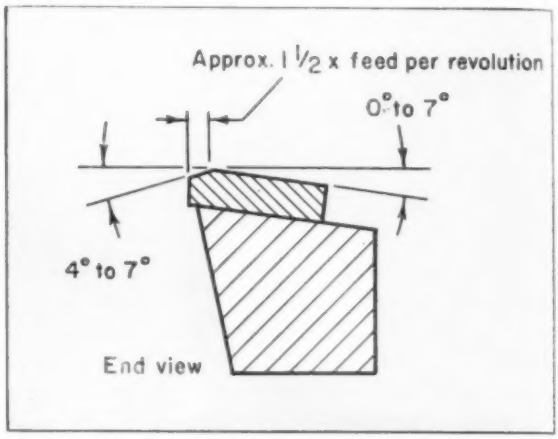


Fig. 6. Negative land rake prevents cutting edges from chipping and can be used instead of chipbreakers in some instances.

A dull tool will cause deflection, either of the tool block, head or platen to which it is attached, or deflection of the workpiece. Other tools engaged in the workpiece are likely to be broken by the sudden impact or movement as the dull tool engages or leaves the workpiece. Again, machine tools may be underpowered, causing slowing down or hesitating of the tool or workpiece, which will cause breakage. The rapid traverse should be examined also as it may be improperly set so that tools are diving into the workpiece under fast traverse.

Tool Chipping: Chipping is a form of breakage often resulting from many of the previously outlined causes. Usually the cutting edge alone is broken away. Chipping may be in the form of saw teeth or look like a large wear land. It shows up as poor finishes or rapid increase in size of the workpiece. Small cracks sometimes accompany chipping and run at right angles to the cutting edge. Chipping may also be considered as the crumbling or crushing of the cutting edge because of excessive pressure.

Strength of the cutting edge should be increased by reducing the rake angle or dubbing off a narrow

band on the rake angle, *Fig.* 6. A negative rake can be tried, particularly on high surface speed applications. The finish grinding on the surface of the cutting edge should be improved to eliminate peaks and valleys which cause the chipping to start. The edges should be blunted lightly by honing at 45 degrees; the rougher the cut, the more honing may be required. This is applicable for heavy cast iron cuts as well as steel. Increased speed and reduced feed may also help eliminate chipping. The higher speeds tend to remove metal easier by increasing the shear angle, reducing chip welding and pressure against the cutting edge. If chipping persists, the depth of cut may be reduced, if it is heavy, or increased if too light. A chamfer, or point angle instead of a radius on the tool, may also help, *Fig.* 7.

Eliminating the chipbreaker often stops tool chipping. The small negative land suggested previously may make this possible. Also, increasing the feed rate will cause heavier chips that may break themselves. A fillet should be tried in the shoulder of the breaker or a 45-degree angle can be used on the back shoulder instead of a right angle. Also, if possible, changes in the metallurgical structure of the workpiece may be desirable to reduce the ductility of the chip, causing it to break more readily. This will require consultation with a metallurgist. Sometimes minute nicks or rough edges, due to handling, are the cause. These can be detected by the fingernail or a 15X lens. To avoid nicks, tools should be coated with plastic and stored individually in compartmented boxes.

Chatter or machine vibration is a major cause of tool chipping. The machine ways may be in poor condition, gibs may be loose, or improper or insufficient lubrication of the ways may be the cause. All stages of tool-holding or clamping should be examined for cleanliness, warping and strength. A chuck dampener or workpiece dampener may be required to eliminate chatter. Chuck jaws should be checked for size since they should be as close to the workpiece diameter as possible.

Tool Burning: Discoloration and smoke accompany cutting action when tools are burned. Such tools are also usually broken down and have sections where the workpieces have smeared the tools. Usually the red hardness of the carbide has been exceeded and the carbide appears to have washed away. Many forms of tool trouble such as chatter, chipping, chip clogging, rubbing and excessive wear will cause a tool to burn also. It is necessary therefore to determine through careful analysis which of the many possible causes are responsible for the burned tool. The various items of design, grinding, feed, speed, depth of cut, setup, chipbreaker, tool condition, carbide or work material, and coolant should be carefully examined as previously discussed.

Cratering: Cratering is difficult to control as it is a common phenomenon when cutting steel and certain allied metals. For best tool life and minimum costs, cratering should take place as far back from the cutting edge as possible. This can be accomplished by changing design of the tool according to tests, *Fig.* 8, and developing optimum feeds and speeds. If excessive cratering persists after an examination of the common causes of tool troubles, the following factors may be applied:

1. Use highest shear angle for minimum chip pressure. This is accomplished by increasing rake; a combination of negative back rake and positive rake may also be used.
2. Use a high chip adhesion temperature grade of carbide, that is, a grade of carbide that resists chip welding until an extremely high cutting temperature is attained. Certain additives in the carbide matrix, such as titanium carbide and tantium carbide, increase its red hardness temperature the same as tungsten increases red hardness temperature of tool steel.
3. Use correct feed and speed combination to reduce

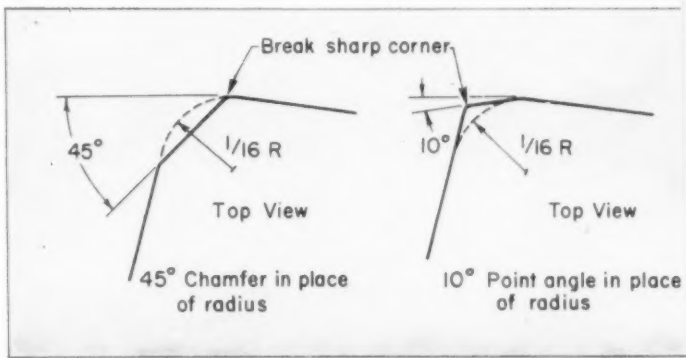


Fig. 7. (upper right) Chamfer or point angle on tool minimizes chip deformation and heat, and increases tool life. Being stronger, such tools reduce chatter and are recommended for tough cutting jobs.

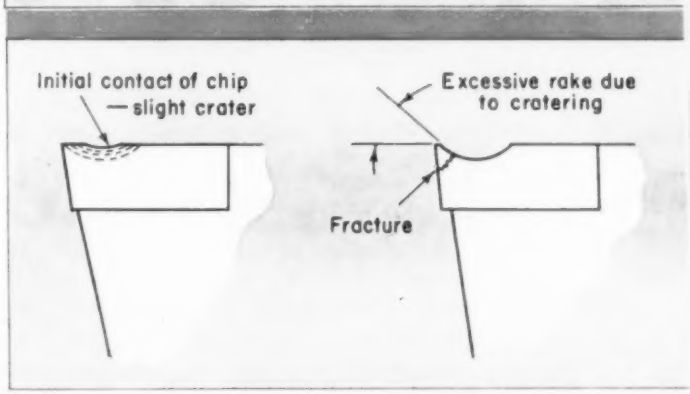


Fig. 8. (lower right) Examples of cratering indicate how an excessive amount causes high rakes and weakens tool.

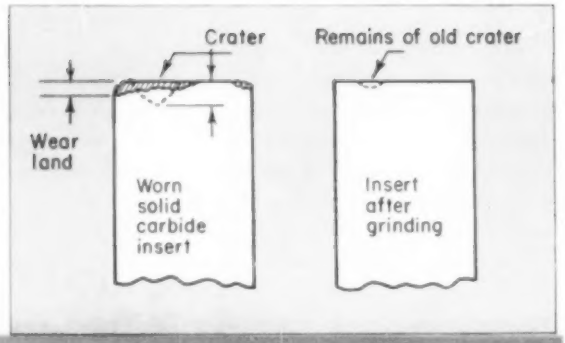


Fig. 9. (upper) Insert tool before (left) and after minimum grinding. It is unnecessary to remove the entire crater.

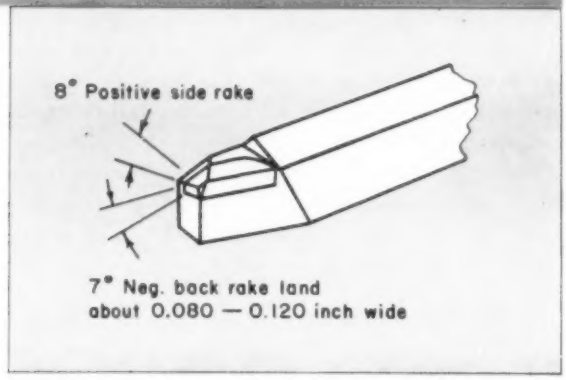


Fig. 10. (lower) Tool reground to clear up cratering with minimum regrinding and minimum tool consumption. The tool can be reground on either front relief or angular top land.

chip friction and erosion. Higher speeds will thin the chip and increase its velocity. Less chip area is in contact with the tool and less heat due to friction may result.

4. Redesign tools so that if cratering persists a regrinding procedure will result in a maximum number of regrinds in tool at a minimum regrinding cost, *Fig.* 9. Single point tools are usually reground on the end. Up to 3/16 inch is removed until all signs of cratering are eliminated. Insert tools can be ground on the top until a sharp cutting edge is obtained and usually much less of the tool is lost.

Another economical device for designing tools to avoid cratering is to have a 0.10-inch back rake land of 7 degrees negative and a side rake on the land of 7 degrees positive, *Fig.* 10. When these tools become dull, they can be reground on both the top land and on the front. Experience has shown that such tools can be reground two or three times as much as other tools.

Rough Finish of Workpiece: The rough surface usually consists of minute welded or torn particles due to build-up, galling marks, chatter marks, or lines due to tool marks and other surface defects. This is one of the most difficult tool problems to correct. Consequently many combinations of factors may be required to eliminate inferior work finishes. Increasing the radius on the tool point will cause cutting lines on the workpiece to overlap. Increasing the rake will facilitate chip removal and prevent build-up. To remove tool marks, reducing the end angle to as low as one degree should help. Increasing the side cutting edge angle will thin the chips and may help. Reducing the relief angle an the front or side of the tool may also be tried. Negative back rake and positive side rake create a shearing edge which may improve the finish. Mirror finishing the rake and relief surfaces of the tool may improve the finish on cast iron and non-ferrous materials. This produces a superfine edge and relieves chip pressure against the rake surface. Tool life is usually improved also. This usually applies to precision finishing.

Honing the tool edge slightly to eliminate ragged edges will prevent minute chipping of the cutting edge and improve the finish on steel. This applies in some instances to cast iron also.

The use of high surface feeds will increase the shear angle during chip formation as the tool is cutting. In turn, the chip thickness is reduced and pressure against the tool face is reduced as is the amount of deformation in the chip. This tends to eliminate build-up on tool and results in excellent finish on the workpiece. A built-up edge not only impedes chip flow, causing rough surfaces, but also reduces tool life. Vibration sometimes builds up in certain geometrical shapes—usually small diameters or disproportionally long pieces. Finish is improved by changing the feed and speed combination causing the condition.

If these suggestions do not improve the finish, other items such as rigidity of the setup, design of chipbreaker, tool condition and grade of carbide should be checked. In some instances, use of extreme pressure coolants or other types of coolants may be useful.

Rubbing: Workpiece material may be smeared along the sides or front of the relief or clearance angles of the tool. In some cases the rubbing causes burning, either of the tool or the workpiece, as indicated by discoloration or darkening. The use of excessive clearances or reliefs may weaken the tool by removing necessary support at the cutting edge. This in turn may cause burning or chatter. Tools with high reliefs, 12 to 18 degrees, have been found, in many instances, to be improved in cutting action and produce more parts per grind. Accurate size control, however, may be affected. Such high relief tools may achieve good performance with the addition of low pressure air-mist cooling.

To prevent workpiece from slipping in chucks, serrations on chuck jaws should be replaced, re-

surfaced or reground for a more positive grip of the workpiece. The carbide plating of workholding jaws or fingers will also contribute to longer life and more positive gripping. In addition to improper chucking pressures, dirt and chips in the chuck may cause difficulty.

Certain types of tools are readily deflected from side to side as well as up and down. This applies to plunging, facing or cutoff tools in particular. The amount of overhang should be no more than the shank height and the tool should be supported on the side opposite the depressor to reduce side deflection. Deflection may cause trouble by causing loss of clearances on end or side cutting edge angles. If the trouble persists, use of solid carbide tools will help.

Boring tools made by different manufacturers may have different heights from bottom of the tool to the rake surface. This should be checked. Standard tools are made with wider tolerances than special tools and possibly various angles may be off enough to cause rubbing. Tools finished to smooth mirror finishes will resist smearing or galling on sides or top of the tools, particularly on forming or grooving tools. When the tool is galled or the workpiece has poor machinability, too low a feed rate and insufficient depth of cut may cause tools to rub or ride over the workpiece. Increased feed, reduced speed or increased depth of cut may relieve this condition.

The setup should be examined to see if the tool is on center. When changing machines from one job to another, blocks having different heights or tools of different heights may have been used. Tool blocks should also be checked to see that tools are held square and level to the workpiece. The flat area on the block that supports the bottom of the tool should be checked to see that it is in good condition, flat and not excessively worn or sprung. Round, solid carbide boring tools with flats, usually used on boring machines, should be held down with flat bottomed screws square to the threads to prevent topping of the tool and loss of clearance. Improper geometry may also be a cause of rubbing and should be one of the first items checked.

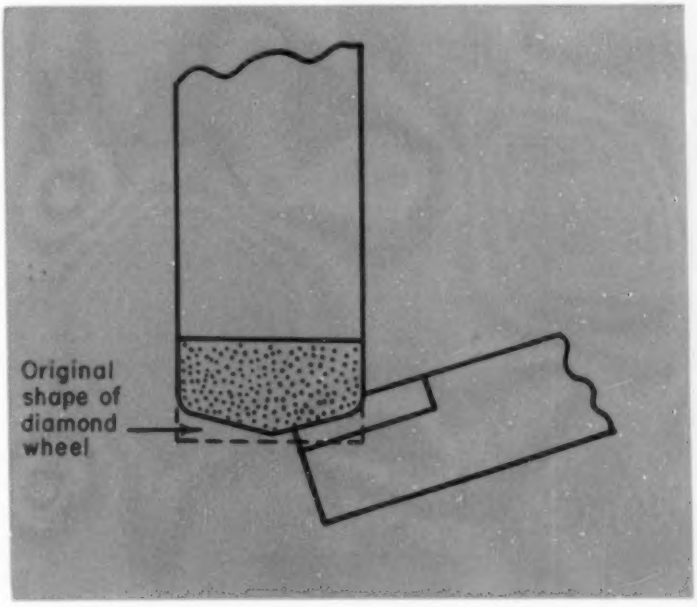
Chip Clogging: The main problem with chip clogging is that it causes excessive down time on production machines. Clogging may also cause broken tools by jamming them against the workpiece or interfering with the cutting action.

Changing the thickness of the chip may relieve some of these problems. A thicker chip may break itself or a thinner chip may be more easily disposed of. Chip thickness may be changed by increasing the lead angle to produce a thinner one or by reducing the lead angle to secure a thicker one. Changes in the rake angle may also assist in better chip disposal. Sometimes changing the tool geometry can change the direction of the chip flow to a point where it no longer interferes with the operation of the machine, thus offering a simple solution. The feed, speed and depth of cut may also be varied to produce the same result.

To transform long stringy chips into short disposable sections, it is necessary to interfere with the free flow of the chip, deforming it so radically that it will break. Chipbreakers for this purpose can be ground into the tool or attached mechanically on top of the rake surface adjacent to the cutting edge. The common practice of grinding chipbreakers with square cornered wheels and presenting a square face to the chip is unnecessary. *Fig.* 11. An angle surface and a radius at the back wall of the chipbreaker performs as well and reduces diamond wheel wear and the cost of grinding.

Chipbreakers should be designed with maximum width and minimum depth. This type of breaker will reduce cratering and erosion of the tip base and extend the tool life.

Fig. 11. Worn diamond wheel can be used to grind chipbreaker by tipping tool. Desirable radius and 0 deg rake on chipbreaker are secured.



Changing the angle of the chipbreaker can improve its efficiency also, *Fig.* 12. Usually chipbreakers are ground parallel to the lead angle, but a chipbreaker ground at an angle to the lead angle will offer a skewed surface to the chip and may perform better with minimum deflection, friction, deformation and heat. When establishing a chipbreaker design, the tool should be operated without it for a length of time sufficient to establish a wear pattern on the top of the tool. Chip flow angle across the top of the tool, distance back of the cut-

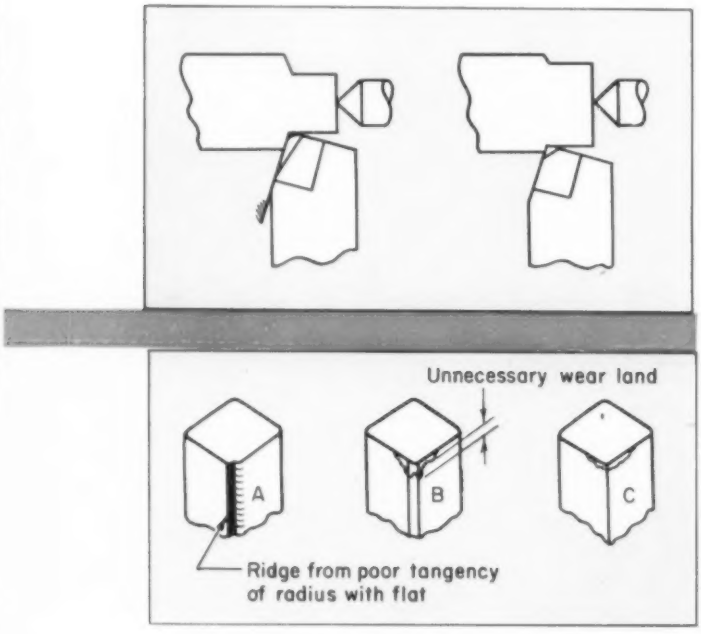
ting edge showing maximum impact, and angle of approach should be considered in designing a chip breaker to deflect the chip sufficiently to cause it to break without creating excessive deflection. Sometimes protruding nuts, bolts, shims, tool blocks, holders, coolant pipes and other protuberances in the vicinity of the cutting tool are the cause of the clogging. Covering such items so they no longer interfere with the flow of chips may solve the problem and reduce machine down time necessary to remove chips.

If operation is dry, a heavy stream of properly directed coolant may be sufficient to solve the chip removal problem.

Excessive Wear: On machines with multiple tools any which become dull much sooner than others are considered to have excessive wear since

Fig. 12. (top) Angled chipbreakers are used for shallow depths of cut. One at right is easier to grind.

Fig. 13. (bottom) Excessive wear on tool A (left) was caused by failure to blend radius in grinding; worn tool at B (center) is reconditioned as at (C) (right) for minimum tool consumption.



it affects production adversely. Usually it is associated with one or more of the items previously discussed so that correction of these difficulties will also improve the tool life. While it may seem that use of a harder or more wear resistance grade of carbide will increase life, this is not often so. The material being cut, feed and speed, depth of cut, machine condition and other factors may all contribute to excessive wear and harder grades of carbide will fail to prolong tool life in the face of these conditions. It has been found in some instances that a softer grade of carbide or one with finer grain and more cobalt can influence tool life. Caution should be exercised when selecting carbide grades for the purpose of increasing tool life as it is necessary to definitely establish whether minute chipping is taking place or the wear is gradual. When cutting on nonferrous materials a keen, sharp edge is of more importance than the carbide grade. If wear is on the rake surface, a harder grade of carbide may improve tool life.

Work material is one of the important factors in determining tool life. Presence of highly abrasive impurities such as silicon or improper grain structure due to faulty heat treat or annealing, may be the source of the difficulty. Other poor machinability factors may be present. To solve these difficulties an experienced metallurgist can be of valuable assistance and should be consulted.

In some instances of poor tool life changing the coolant and flushing the machine may show marked improvement. Coolant ratios or concentration may be improper for the operation. Some experimenting with the coolant may produce beneficial results. Coolants contaminated with excessive sulphur, suspended particles, hydraulic oil or lubrication oil, will adversely affect tool life. Because of these factors, when checking coolants for the purpose of improving tool life, it is important to try a fresh tank of the existing coolant before going to another type. Application of the coolant with pressure from beneath the tool may also help.

Since single-point carbide tipped tools are the most inexpensive, the ultimate cost of excessive wear is often underestimated. Reconditioning a slightly dull tool may cost only one-tenth as much as reconditioning an excessively worn one, *Fig.* 13. In some cases, regrinding costs of excessively dull tools may be nearer the price of a new tool. Excessively worn tools almost invariably cause scrap, often break and may cause expensive machine breakdown. Another common fault in the use of single-point tools is due to grinding room practices. Because of apparent simplicity and low cost such tools are usually reground by the newest or most inexperienced man. These tools should be handled and reground with the same care and caution given more expensive ones. Rigid inspection of reground tools should be maintained to insure correct geometry and quality. The same philosophy should be considered in designing single-point tools. All too often the tool design department head assigns single-point tools to the newest and most inexperienced man since they are so easy to draw and apparently little knowledge is required. This is a major fallacy. Dollarwise, more money is probably spent on such tools than any other in the average plant, so that as much or even more care should be given to their design.

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Quick Acting Clamp

Where light clamping pressures are required such as for light drilling operations, assembly operations, etc., this clamp is useful. It operates with an over-center mechanism such as found in snap switches. The clamp is pivoted on the body of the jig or fixture and has a projection on the center line of the pivot pin. A similar projection is mounted in the body of the fixture and a compression spring is held between these two projections.

As the view of the clamped position shows, with the workpiece in place, the spring exerts a constant pressure on the clamp to hold the workpiece. When the handle end is depressed, the toggle action holds the clamp in the open position.

In actual practice, the two angles *a* and *b* shown on the drawing should be approximately 30 degrees to hold the spring in place. The holding force exerted against the workpiece is readily determined if the force, *P*, of the spring in the clamped position is known. Then the work clamping force becomes *P (C/D)*, where *C* and *D* are the moment arms shown in the sketch.

The two projections for the spring pivots are readily constructed as shown in the enlarged views by slotting a spherical ended pin and inserting a flat piece of stock with a radius on one edge. If a press fit hole is drilled in the body of the jig and a slot milled for the flat piece of stock, the button may be assembled as shown.

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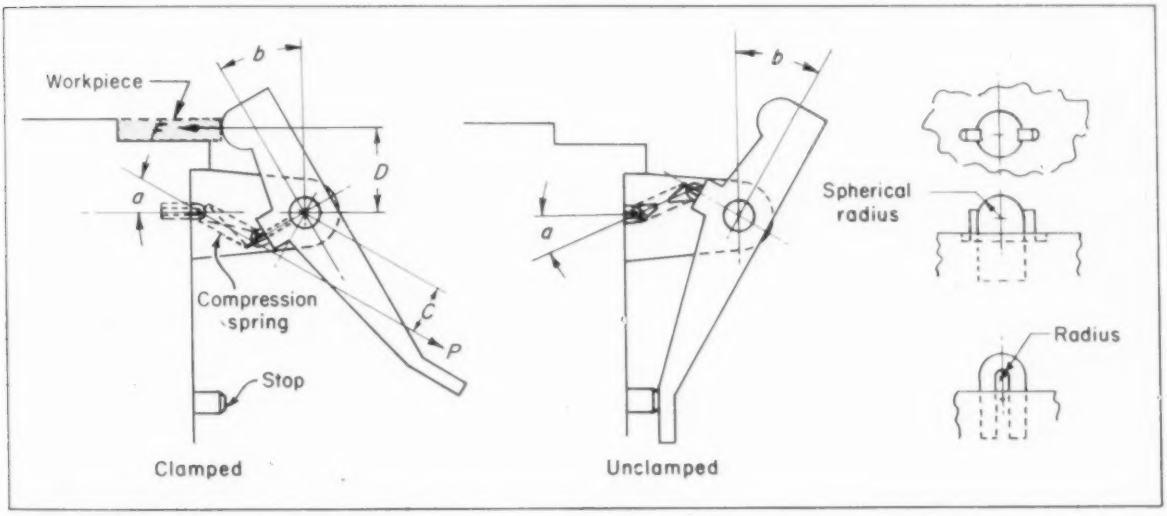


Multiple Action Die

In a single operation, this combination press tool pierces three holes located at different angles to each other and also flanges a collar from the inside of one of the holes. The cross-section view shows the position of the workpiece in the die. Holes *a* and *b* are pierced at 55 and 90 degrees, respectively, and hole *c* is pierced and flanged at 35 degrees in relation to the horizontal plane.

When the press ram descends, four coil springs actuate the movable punch holder. After it comes in contact with the shell, which rests on a steel ring, the ram pushes the shell down until it rests on the die. The ring is actuated by three small coil springs. When the press ram continues downward the top coil springs are compressed and hold the shell firmly on the die. One punch pierces hole *b* and at the same time hole *a* is pierced by another punch. These punches are actuated by steel blocks which are beveled and fastened to an upper punch holder.

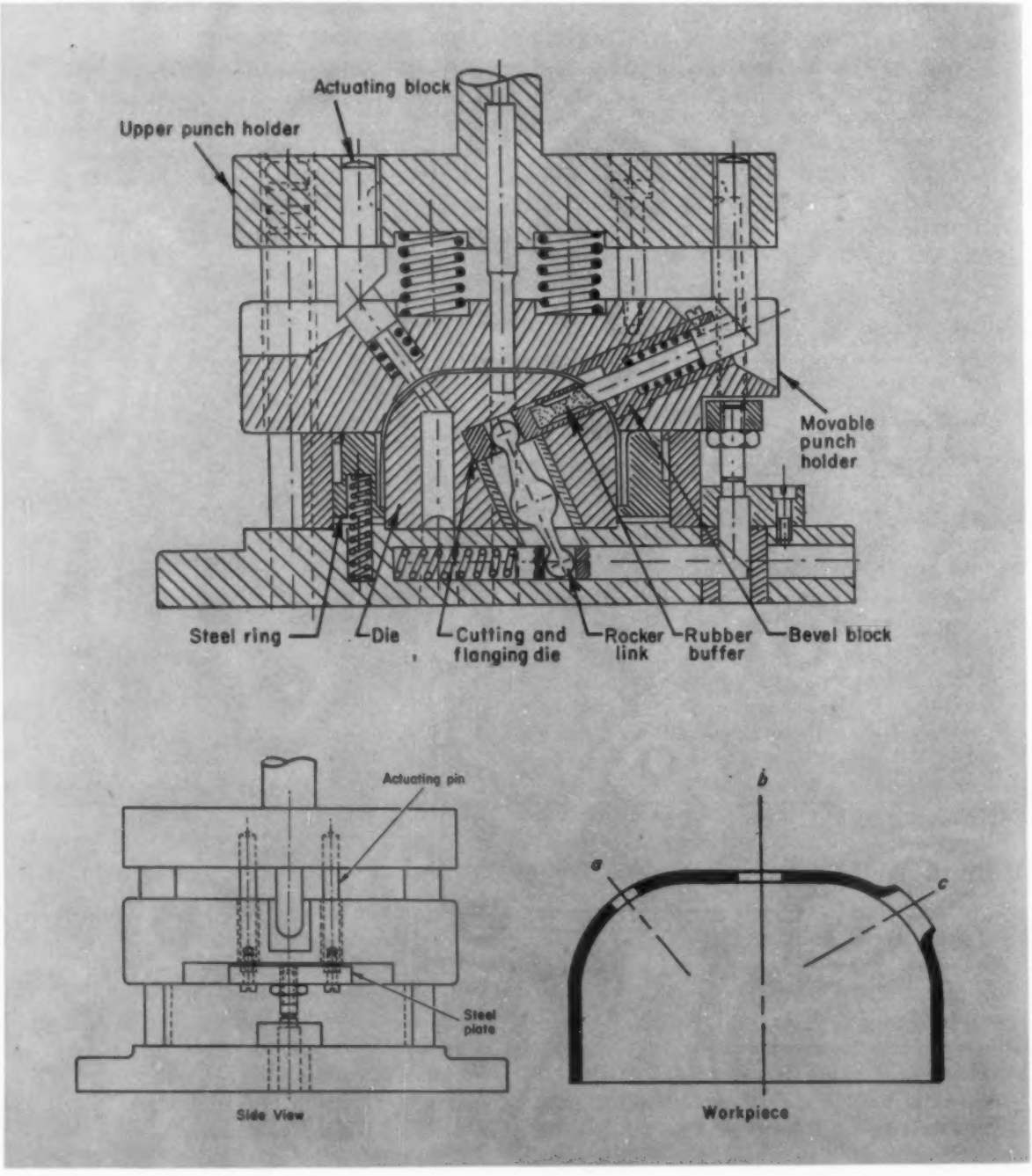
Simultaneously hole *c* is pierced by a third steel

punch, actuated in the same manner by a bevel block. During this piercing operation the ram movement is only about 1/16 inch. The rubber buffer, inside the movable cutting and flanging die, is compressed by the piercing punch. The flanging die is at the bottom position in its hole in the die. When the ram descends a little further, a beveled steel block is forced downward, moving a steel link to the left, causing a rocker link to swing which forces the flanging die outward. Thus the small sheet metal ring around the pierced hole *c* is flanged.

The scrap from this hole is blown away by air pressure. The flanging device for the hole consists of a steel block, horizontal linkage, coilspring, the rocker link, and the flanging die, which are all actuated by the same steel pin, fastened in a steel plate. This, in turn, is actuated by two steel pins, as shown more clearly in the side view. These two pins are fastened in the upper punch holder but have a sliding fit through the movable punch holder. The flanging device is therefore operated by movement of the upper punch holder and is independent of the movable punch holder.

This tool has been in satisfactory operation for some time with few adjustments required.

Hjalmar Dahl
Uplands Vasby, Sweden



Locating Stop for Automatic Lathe

One operation has been eliminated in machining gears by a novel type of locating stop for the expanding arbor of a Sunstrand. These gears are cast iron and come directly to the lathes from an ID broach. Originally, on the first lathe the gears were OD turned and faced on one side. On the second lathe the gears were reversed and faced on the second side. Work was held on expanding arbors with shoulders to position the blanks for the facing tools.

On the new setup both facing operations are combined with the OD turning on one lathe by eliminating the shoulder on the expanding arbor and replacing this locating device with one on the front cross side of the lathe. As shown, the locator is cut out to clear the arbor. This design provides sufficient area to position the gear.

When the lathe is started, the front slide feeds to the left, carrying the turning tool into the work and moving the locator away from the work to clear the facing tool on the rear slide.

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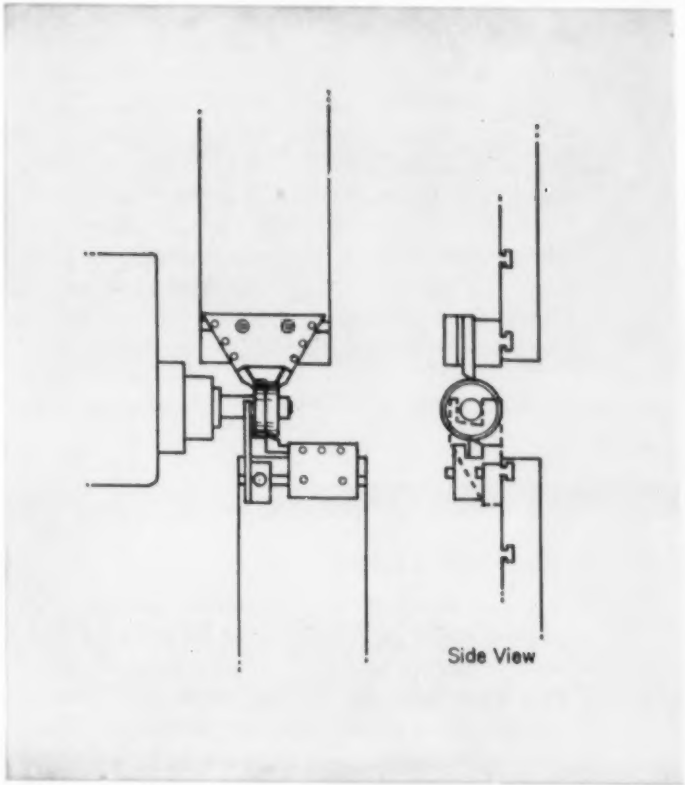
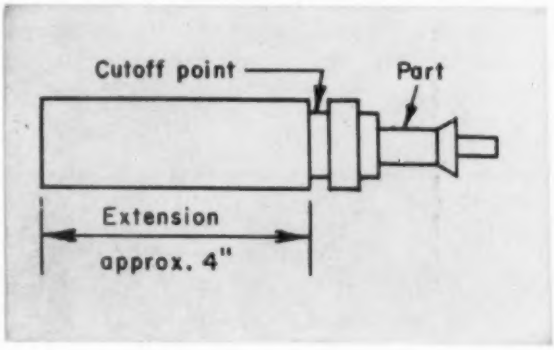
Western Michigan Chapter



Setup Guide

To assist in setting up reruns of jobs on machines such as 6-spindle automatics or turret lathes, it is helpful to be able to use a sample part as a guide. Such a guide is easily prepared by pulling a finished part out of the collet a few inches before cutting it off, thus leaving an extension on it. The part with the extension for holding it can then be used to set the tools whenever the job is run. This often saves many hours of setup time.

George J. Whitley
Philadelphia Chapter



Burr Problems with Stampings

Burrs, always present on the top edge of a blank that is in contact with the punch, can be troublesome if the blank is to undergo some further forming operation. This is especially true with thick stock when using dull punches.

For the succeeding bending or forming operation the burred side of the part should be the side which is under compression rather than tension. Otherwise, as the metal stretches it is likely to split or rupture, as shown in sketches.

In some cases this rule cannot be followed, of course, such as with compound forming, too small an angle of bend or stock of too high tensile strength. In these instances burrs must be eliminated after blanking and before the forming operation, which calls for tumbling.

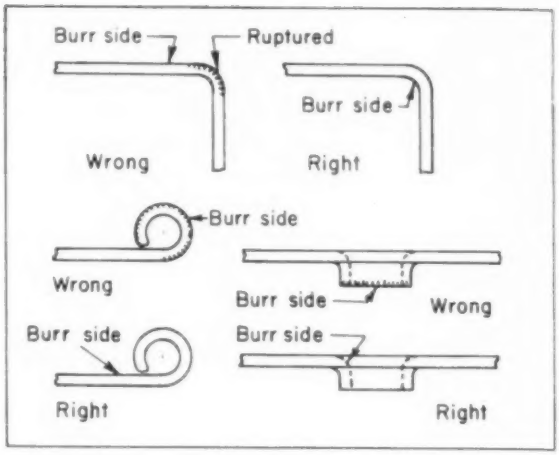
While apparently a simple process, this involves

Contributions for these pages describing short cuts for the tool engineer are welcome. Finished drawings are not necessary. Payment for accepted articles is made upon publication.

a number of considerations which can, if properly applied, facilitate production and improve quality of stampings. Selection of the correct drum shape is a matter of practical experience and personal judgment. Other factors which influence the efficiency of the operation are size of drum, speed, duration of the operation, kind, size and quantity of tumbling alone may be insufficient to prevent

In severe cases, especially when the material is a high tensile strength alloy, or for small radii bends, tumbling alone may be insufficient to prevent cracking, fracturing or rupturing in the bending zone. Such stampings should be annealed.

Federico Strasser
Santiago de Chile



Driving Sleeve

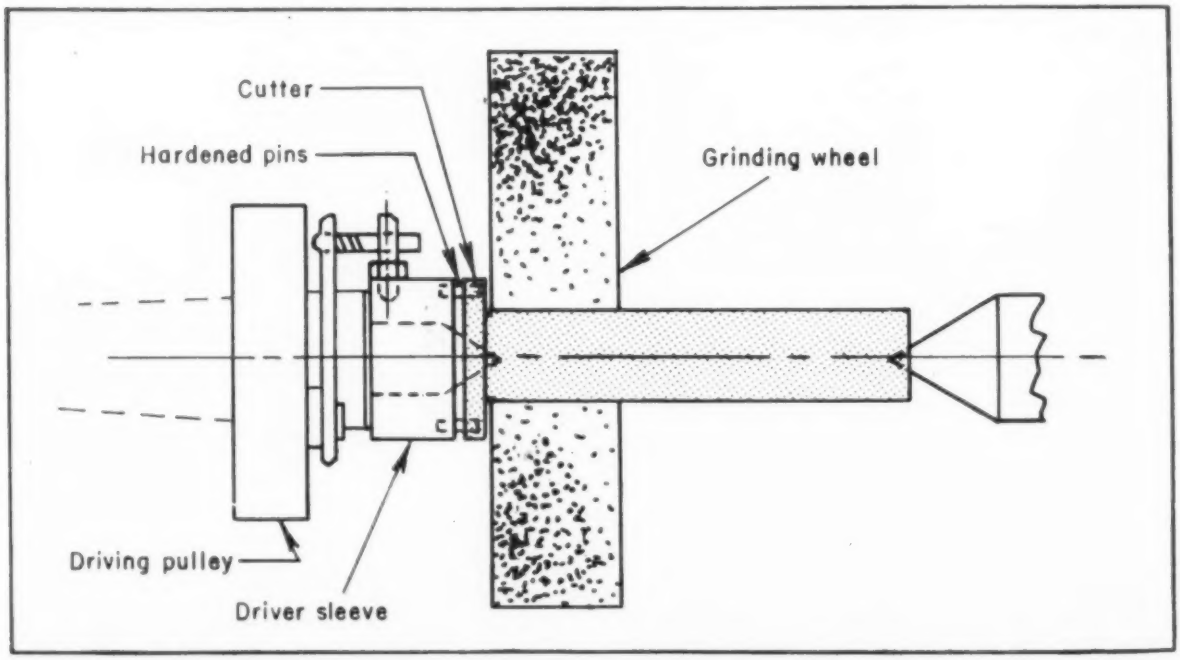
Some Woodruff keyseat cutters, on which the shanks are to be ground close to the head, have teeth so narrow that a dog can not be used without interfering with the grinding wheel. To overcome the difficulty a driving sleeve was devised as follows: the headstock center was ground to ½-inch diameter about 1 inch from the point and a sleeve was made with its hole a running fit to the center end. The sleeve was made just long enough to clear the end of the cutter.

Two hardened pins were driven in the end of the sleeve to engage the teeth of the cutter. The pins are of a proper length so they do not project beyond the teeth. A hole was drilled and tapped near the other end of the sleeve and a headless screw placed in and held rigid with a locknut.

This headless screw engages a screw in the driver, allowing the cutter to be driven by the two hardened pins and permitting the grinding wheel to grind close to the head of the cutter as shown in the accompanying sketch.

Other similar drivers were made and are still used for driving flat reamers, gages, other tools, and even production parts, with irregularly shaped or slotted ends. Such drivers offer considerable saving in time in changing pieces on the machine by allowing the operator to grind the whole piece without changing the dog from one end to the other.

Floyd E. Blankman
Syracuse, N. Y.



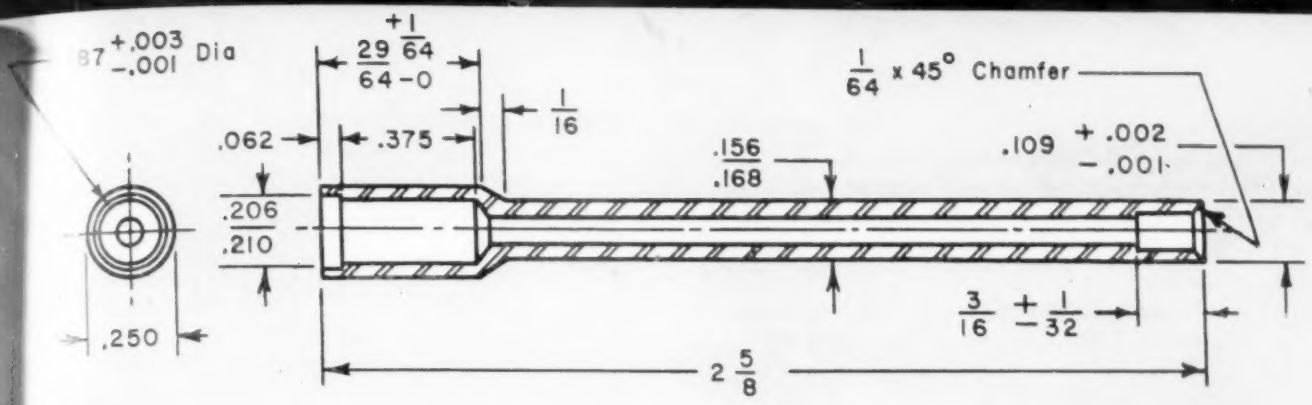


Fig. 1. Stainless steel bulb that was difficult to drill, impossible to form and impractical to swage.

swing tool

solves tube machining problem

By Clifford H. Becker*

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A SPECIALLY DESIGNED swing tool has lowered production costs and relieved a production bottleneck in the manufacture of stainless steel bulbs, *Fig.* 1. Steps leading to the design of this swing tool are interesting because they indicate the many possible solutions to a single problem and show how small factors can make otherwise good tooling unuseable. Machining of Type 446 stainless steel is always a problem but becomes especially acute when thin sections of stainless steel are to be machined.

Initially the part was machined from tubing on an automatic using a knee tool to remove the stock from the reduced section. Difficulty arose during the second operation of drilling the large end. Either the part had to be put in the collet with the large end inside where coolant couldn't reach it, which was impractical, or it had to be chucked on the 0.156-in. diameter. The latter method proved impractical too, because excessive torque resulted when using a drill larger than the chucking diameter. Periodically pieces would spin in the collet chuck.

In an attempt to reduce costs the production problem was analyzed and various alternate meth-

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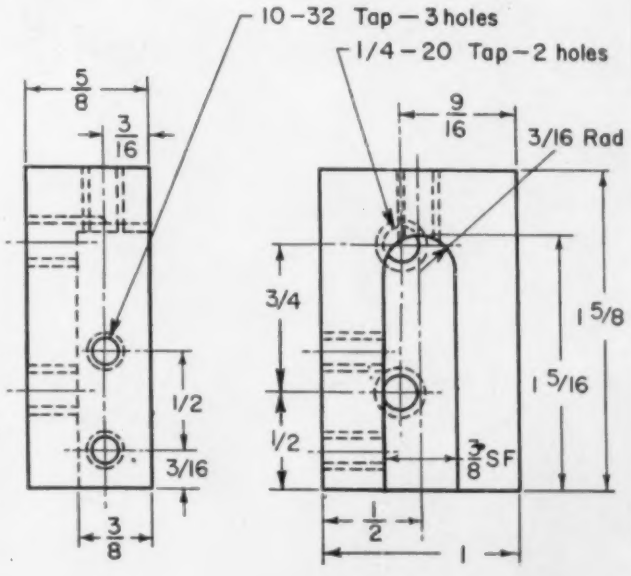
Fig. 2 Special tool block is adjustable so optimum effective rake angle can be presented to part.

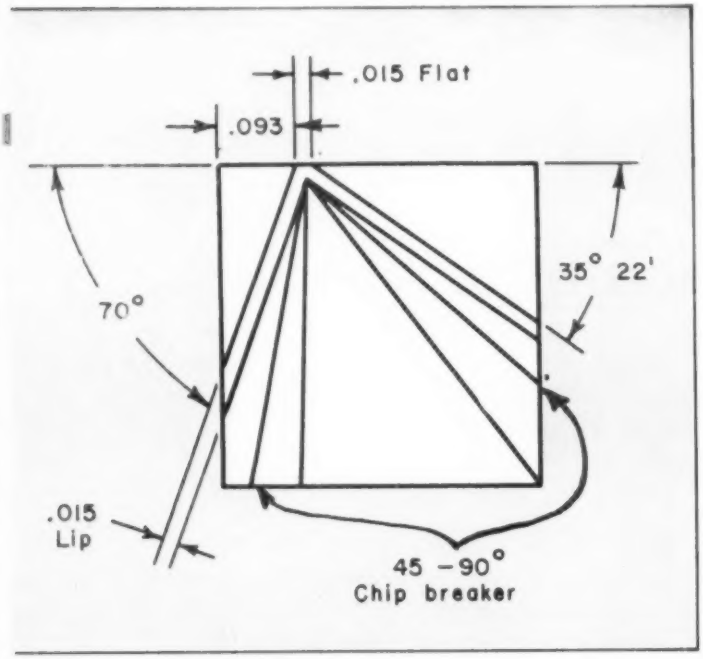


ods were suggested and tested. One approach was to swage the reduced section to size. This method was unsuccessful because it created microscopic cracks. Since the bulb is used at elevated temperatures, the microscopic cracks led to intergranular corrosion.

Forming the part from solid rod was impractical because of the length of the part compared to the drill size. Problems of cooling and long production time were introduced by this method. Heavy pressures used to form the part from tubing were excessive for the thin walls and this method had to be abandoned because the large diameter section deformed and broke off.

Analysis of all the factors indicated that the box tool principle did a satisfactory job in the removal of stock from the neck-down area, but resulted in high cost due to the second operations. It also presented clamping difficulties. If the part could be produced by drilling the large hole and at the same time removing the excess stock from the reduced diameter, good production would result. The indicated solution was a box tool that would start cutting beyond the large diameter of the part and be removable when the cut was completed. To do this, the part had to be recess turned with the large end out.

Fig. 3. Chip curler and breaker used with the adjustable tool block.



Special Holder Needed

A survey of all commercial tool holders on the market showed that none could do the required job. It was decided to design a special holder. The first design comprised a standard swing tool with a hardened bushing pressed into the shank as a support for the stock. The large cutting forces required caused the sleeve and part to gall.

The second attempt avoided this problem by using a ball bearing with a hardened internal sleeve. Here again the cutting forces were too great and the bearing balls were crushed, making the tool ineffectual. Next, a special bracket with a hardened V support was mounted on a standard swing tool ahead of the cut. The V galled and picked up material.

The final attempt that led to the eventual design was to support the stock just ahead of the cut by rigidly supported rollers. Results were good but indicated that the rollers and tool should be adjustable to reduce chatter and insure good surface finish. With the adjustable tool block, *Fig.* 2, the effective rake angle of the tool can be changed to maximum efficiency without regrinding the tool. This is especially important when setting up a new job. Adjustability of the tool block also permitted optimum rake angle for the chip breaker, *Fig.* 3.

A special indexing drilling machine is used to counterbore the small end of the tube. The final design of the swing tool, *Fig.* 4, has lengthened production runs, reduced down time and saved four hours of direct labor per 1000 pieces produced. These savings amortized the cost of the special tool in just a few months.

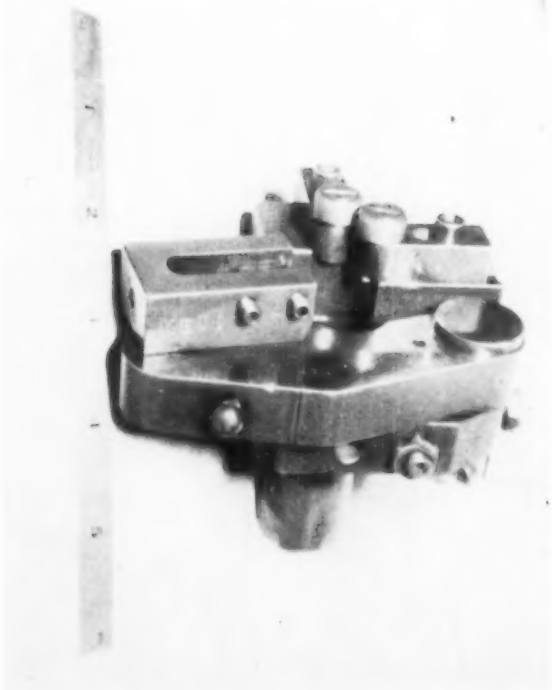


Fig. 4. Swing tool especially designed to produce the part shown in Fig. 1.

electric controls

Part 1—Basic building blocks

By John C. Ponstingl

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INDUSTRIAL ELECTRIC CONTROL components and circuits have been developed to the point where so many different types are available that their application usually requires highly trained engineers. Actually, the choice of an electric control for a particular machine drive or operation is simple when the problem is understood and the control functions are recognized.

Detailed articles have been written on many types of industrial controls, giving both their system and component characteristics. However, this information has not been organized so that a bird's-eye view can be taken of the possible requirements and available characteristics. If the tool engineer, who recognizes his problem, gets together with a control engineer, who knows solutions, application can be worked out successfully. *Fig.* 1 shows part of a control system to operate and protect a d-c motored machine tool. *Figs.* 2 and 3 also illustrate typical control panels.

When the tool engineer is familiar with the engineering features of control components he is in a better position either to work out the problem himself or guide the control specialist. The result is a better machine. It costs less, has better performance and requires less maintenance.

This article will outline, in logical sequence, the basic interrelations of components in power control circuits. From this, the tool engineer can visualize the scope of industrial control problems. Design of the control for a particular application is dependent upon the following:

1. Functions of the machine or device.
2. Restrictions or limitations placed upon the equipment. This could involve safety features, electrical codes, insurance codes, power supply or other limitations.
3. Characteristics of the motors or devices to be controlled.
4. Type of maintenance schedule permitted.
5. Expected service life of the equipment or machine.
6. Value of machine and materials in process that might be affected by malfunction or misoperation of controls.

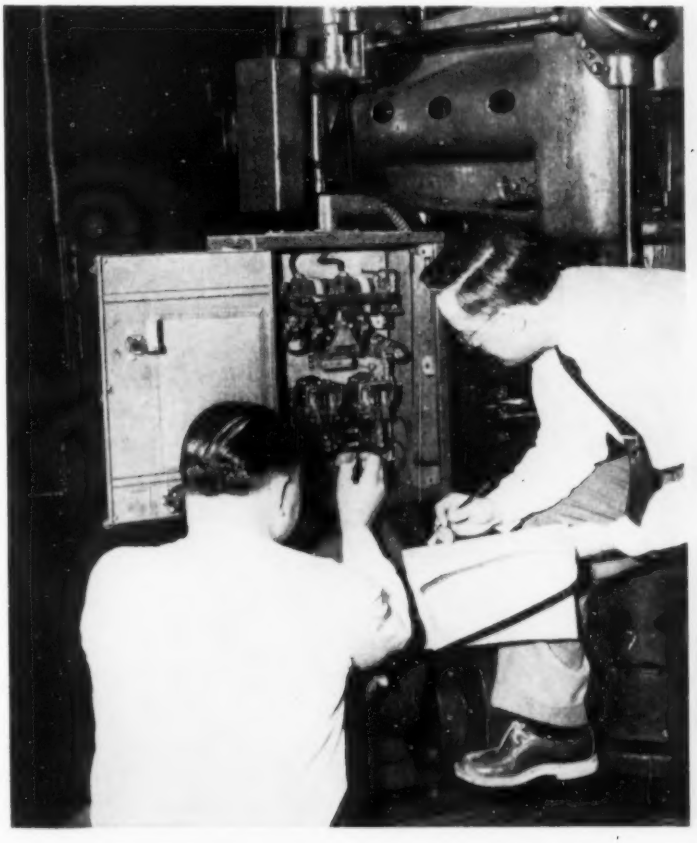


Fig. 1. Engineers checking basic blocks in a machine control panel for the power circuit.

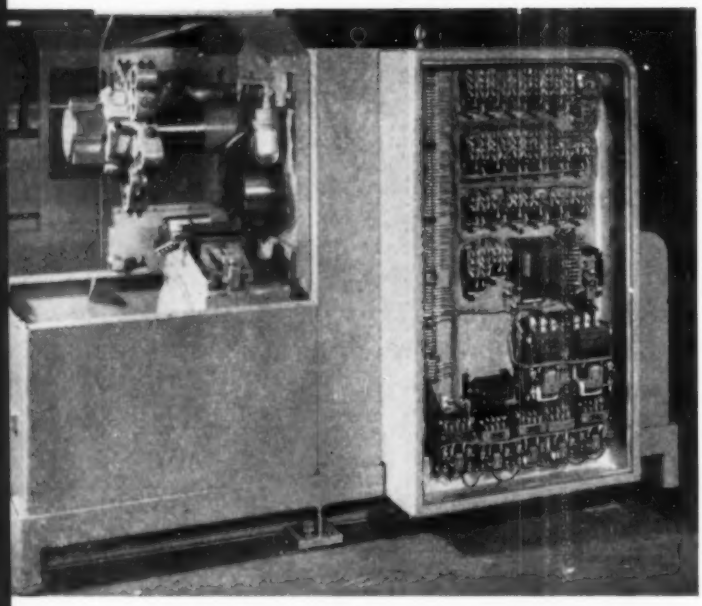


Fig. 2. Typical machine control using circuit breaker, magnetic starters and thermal overload relays mounted in cabinet on the machine.

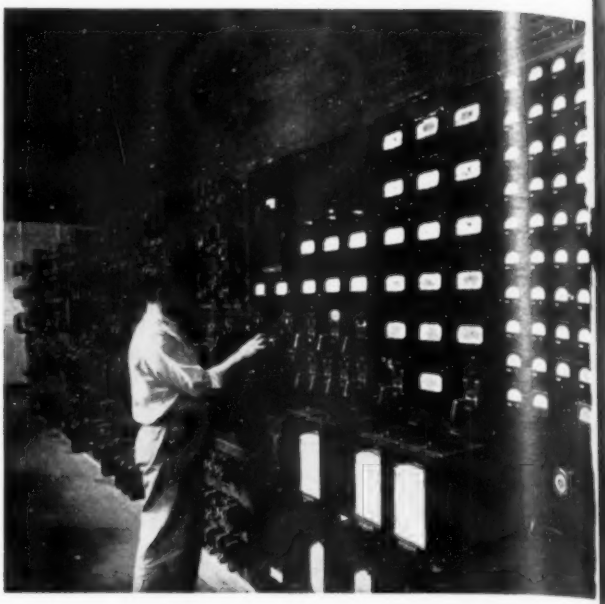


Fig. 3. Regardless of how involved a control may appear it can be reduced to basic building blocks to simplify understanding and maintenance.

Design of industrial controls involves selecting proper components and arranging them in circuits to accomplish the desired results with the minimum number of parts consistent with foolproof operation. Operators, machines and work in progress should be protected by the control system chosen.

Classification of Building Blocks

Two basic types of circuits are involved: power circuits and pilot control circuits. Power circuits connect the electric source to electric motors. Pilot control circuits connect such accessories as push-buttons, relays, limit switches, etc., in combinations to control the operation of power circuits. Although a pilot circuit always has a power circuit associated with it, power circuits are often used by themselves in the control of a motor. Circuits frequently become more complex when they must perform a multiplicity of sequencing operations in a particular application. Pilot control circuits will be discussed in a later article.

The National Board of Fire Underwriters, American Institute of Electrical Engineers and JIC have set up practical rules to be followed in making up power control circuits, so that each of the following is protected against itself and its surrounding environment:

1. Power source.
2. Conductors connecting the power source and the motor.
3. Motor.

The basic elements for any electric motor drive consist of four types of equipment. The branch power circuit must have a disconnect switch to isolate the entire circuit and an overcurrent protection device to protect the feeder against overheating and short circuits. For the motor, there must be a starter or controller, making possible the desired operating characteristics of the drive, and motor overcurrent protection, guarding the motor against overheating resulting from overloads and single phasing.

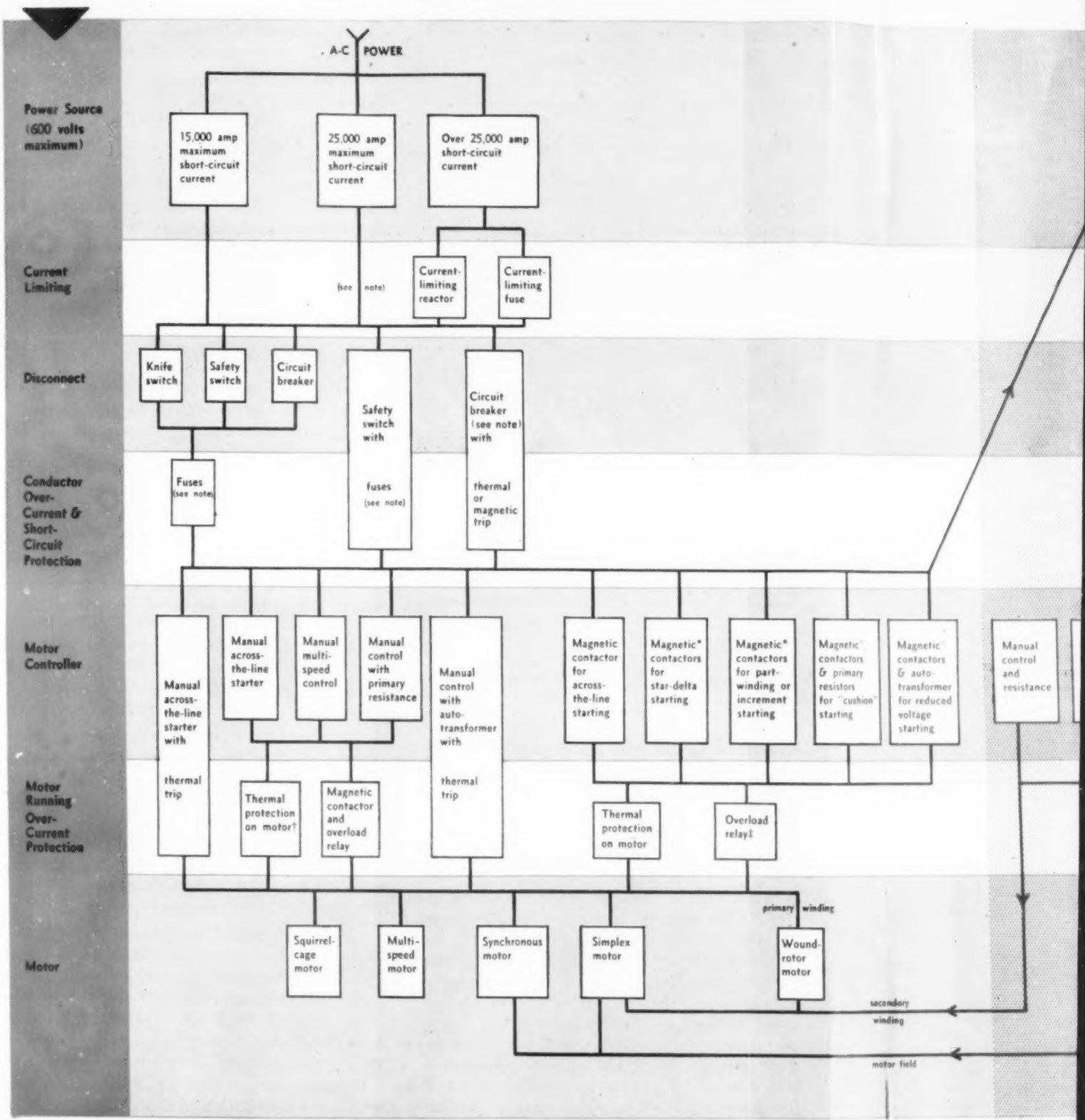
As a guide, TABLE 1 shows a logical grouping of basic control elements needed to link a given power supply to a particular motor. This chart shows how power connections may be made from any power source to any type of motor. It is an "organizational chart" and is so arranged that all similar types of devices—such as current-limiting devices, disconnect switches, etc.—are grouped horizontally across the chart.

Illustrates Choice of Controls

This chart is useful as a guide to the tool engineer. Where a particular electric motor is to be controlled, any path from the power supply block to the motor passes through a series of blocks for devices that are needed to make a good control installation. A study of the chart shows that many paths can be taken. However, certain practical or commercial limitations will dictate a preferred path.

The type of motor being driven affects the choice of its control. For example, a single-speed squirrel-cage motor needs only a single set of contacts for connecting the motor to the line. A multispeed squirrel-cage motor, however, must have a line connection for each speed. A wound-rotor motor

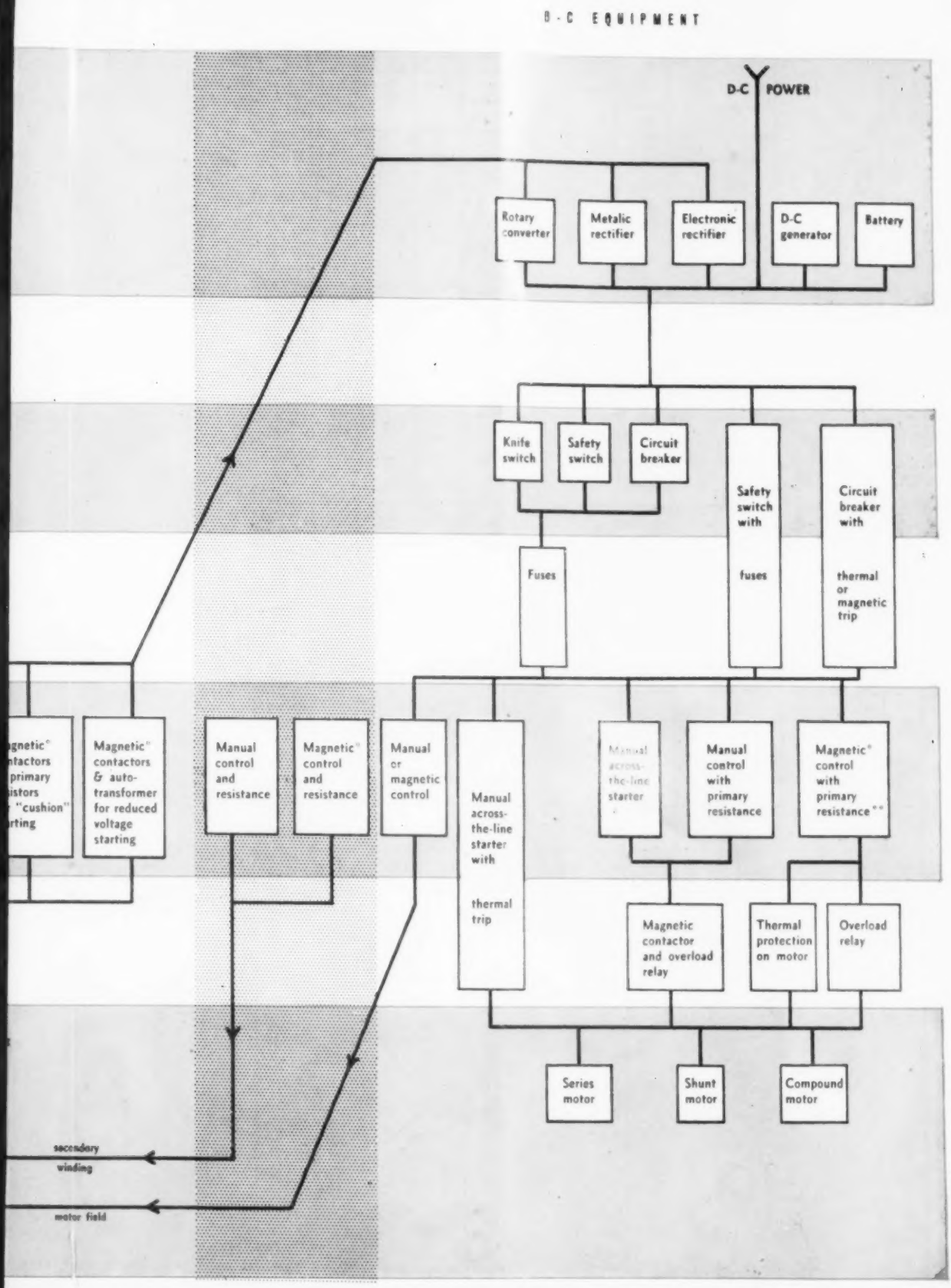
Table 1–Industrial Control Power-Flow Chart



Note—When the power supply is capable of producing more than 15,000 amp short-circuit, and not more tran 25,000 amp, then the fuses or circuit breaker chosen must be capable of interrupting that short-circuit current. Not all fuses or circuit breakers are capable of interrupting as much as 25,000 amperes.

*These starters include appropriate relays to control the accelerating cycle.
†Thermal protection on single-phase motors only.
‡The overload relay may be of the thermal, inductive, or magnetic-dashpot type.
**Motors 2 hp and smaller may not require the primary resistance, using only a magnetic contactor for across-the-line starting.

trol Power-Flow Chart



e relays to control the accelerating cycle.
se motors only.
e thermal, inductive, or magnetic-dashpot type.
ot require the primary resistance, using only a
e-line starting.

Manual indicates that the contacts are closed manually through a suitable mechanical link.

Magnet indicates that an electromagnet system provides the motivating power to close the various contacts. The operating coil on the magnet is energized through a suitable push-button or pilot circuit.

Table 2—Typical Commercially Available Controls and Their Horsepower Ratings

Starter			ALTERNATING CURRENT						DIRECT CURRENT			
			Manual			Magnetic			Manual		Magnetic	
HP	Volts	Size	Line Start	Resistor Type	Auto Transformer Type	Line Start	Resistor Type	Auto Transformer Type	Line Start	Resistor Type	Line Start	Resistor Type
1	208, 550	00										
2	208, 220 440, 550	0 0										
3	208, 220 440, 550	1 1										
5	208, 220 440, 550	1 1										
7½	208, 220 440, 550	2 1										
10	208, 220 440, 550	2 2										
15	208, 220 440, 550	2 2										
20	208, 220 440, 550	3 2										
25	208, 220 440, 550	3 2										
30	208, 220 440, 550	3 3										
40	208, 220 440, 550	4 3										
50	208, 220 440, 550	4 3										
60	208, 220 440, 550	5 4										
75	208, 220 440, 550	5 4										
100	208, 220 440, 550	5 4										
125	220 440, 550	6 5										
150	220 440, 550	6 5										
200	220 440, 550	6 5										

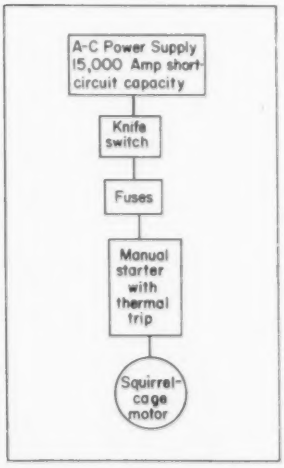


Fig. 4. Block control diagram for a 3-phase, squirrel-cage motor.

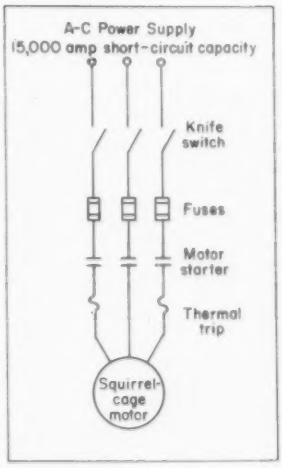


Fig. 5. Schematic wiring diagram for a 3-phase squirrel-cage motor.

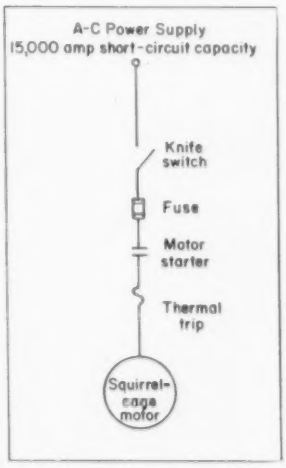


Fig. 6. One-line diagram of the circuit shown in *Figs.* 2 and 3.

requires additional control for inserting resistance in the rotor circuit for motor starting and speed control. A synchronous motor, in addition to a-c control, needs additional control to connect its d-c excitation field. A d-c motor needs the proper

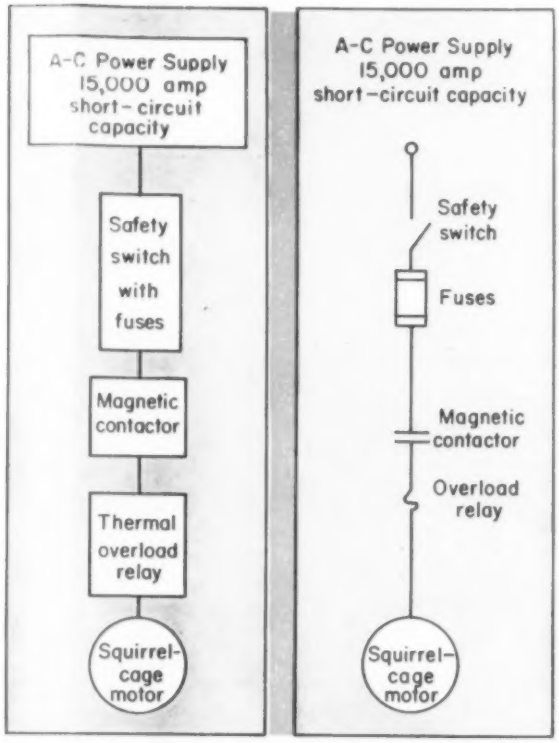


Fig. 7. (left) Typical squirrel-cage motor control circuit developed from Table 1.

Fig. 8. (right) One-line diagram for the circuit in *Fig.* 5.

control to connect the power supply, possibly through starting resistors, to the motor.

The horsepower rating of the motor, the power-supply voltage and other characteristics determine the size of the control required. For example, a manual type starter with only a thermal trip probably would not be picked for a 100-hp motor. On the other hand, a magnetic starter and autotransformer, for reduced voltage starting, probably would not be picked for a ½-hp motor.

Typical commercial controls are listed in TABLE 2 together with their horsepower ranges. To make effective use of materials and space, controls are sized for groupings of current and power. A Size 1 starter, for example, can be used for a 3-hp, 220-volt motor or a 7½-hp, 440-volt motor. Sometimes certain industries such as steel mills may use a Size 3 starter for a 3-hp motor. TABLE 2 is not all-inclusive, but it does indicate that certain type starters, such as d-c motor linestarters, are restricted to relatively small motors. Later articles will discuss in more detail the features of a-c and d-c control and why some starters are limited to certain motor horsepower capacities. How electrical characteristics of the power supply influence control selection will also be discussed.

One common control involves connecting a typical low-capacity a-c power source (15,000 amp maximum short-circuit capacity) to a small (for instance, 1-hp) three-phase motor. Referring to TABLE 1, the simplest combination would consist of a knife switch, fuses and manual starter with a thermal trip. There are many inadequate installations where only a knife switch and fuse control the motor. According to TABLE 1, however, a knife switch and fuse are not sufficient because it is impossible to trace a path from the a-c power supply to the motor without including certain other devices.

Diagrams Aid in Selection

Such a path, includes all the necessary control components as shown in the block diagram in *Fig.* 4. *Fig.* 5 shows the actual wiring schematic. Sometimes, for purposes of simplification, so-called one-line diagrams or schematics are used. *Fig.* 6 shows the circuit in a one-line diagram wherein schematic symbols are substituted for the blocks in TABLE 1 and *Fig.* 4.

To show the flexibility of TABLE 1, other paths could be chosen from the power source to the same motor. *Fig.* 7 shows another typical circuit. The one-line diagram would be represented as shown in *Fig.* 8. In actual practice, the motor control and overload protection are often put in one enclosure (called a motor linestarter) and the branch circuit protection and disconnect switch are put in another.

The most modern system consists of a circuit breaker, magnetic contactor and overload relay as shown in *Fig.* 9. These elements are usually combined in one enclosure and called a combination linestarter. Since all elements are wired and mounted in one enclosure, field installation of the combination linestarter is less expensive than the installation of individual units. In general, the trend is toward such factory-packaged controls.

Usually, the type of enclosure is not influential in the choice of control as outlined in TABLE 1. However, factors such as unusual conditions of water, dust and corrosive or explosive atmospheres might interfere with proper operation of the control. Protective enclosures have been classified by the National Electrical Manufacturers Association.

Referring again to TABLE 1, it may be used to work out a system for a particular machine using, for instance, a d-c shunt-motor drive, and an available 440-volt a-c power source with a short-circuit capacity of less than 15,000 amp.

Any path on TABLE 1 from the a-c power source, 600 volts or under (short circuit current less than 15,000 amp) to the shunt motor will include all the basic devices that will be needed to complete a circuit from the a-c supply to the d-c motor.

In so doing, however, two conductor-overcurrent-protection devices are listed. If, according to code, the overcurrent device in the a-c section of the circuit is the same as the overcurrent device in the d-c section of the circuit, then there is no need of having two conductor-over-current-protection devices. The circuit could correspond to *Fig.* 10.

Using TABLE 1 as a guide, keeping in mind all the code requirements, applicable controls may be evaluated for:

1. Performance.
2. Dependability.
3. Installation requirements.
4. Maintenance provisions.
5. Cost.

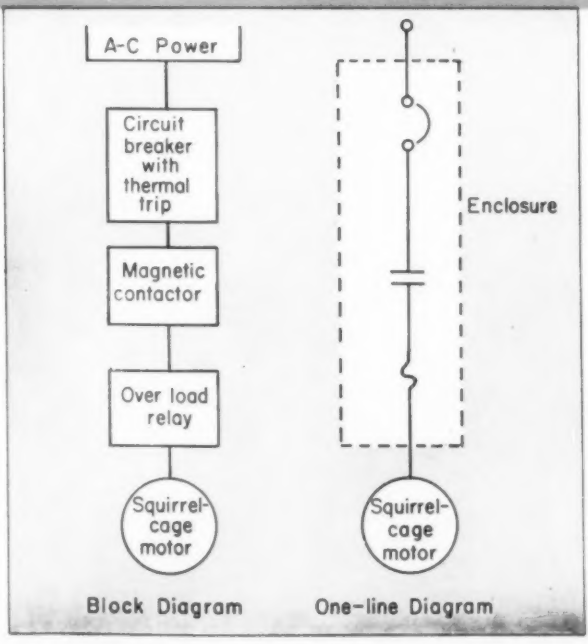
The control choice becomes almost self-evident. Electric controls may be selected for many reasons, some of which are:

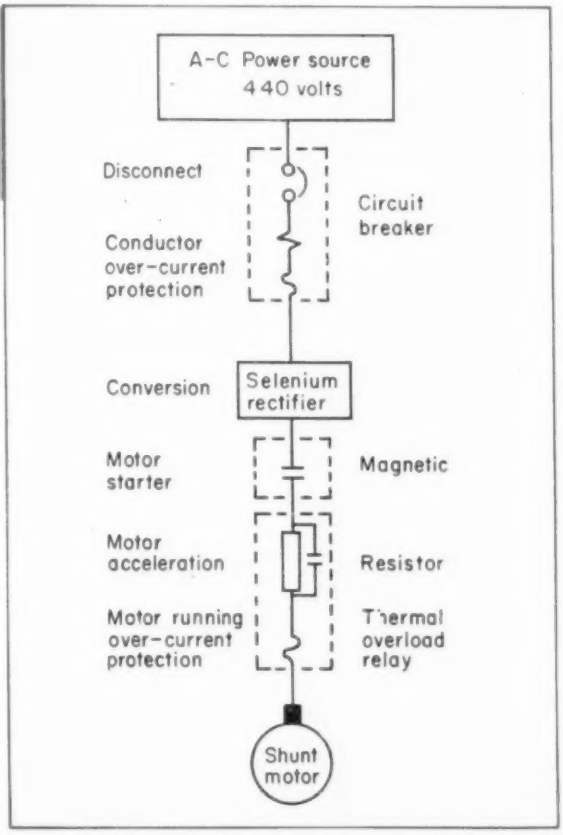
1. When an electric motor is installed to convert from group drives to individual drives, from individual drives to multimotor drives or from some other drive (such as gas engine, turbine, hydraulic, or pneumatic) to an electric motor.
2. In replacing old or obsolete control, it may be desirable to go beyond duplicating the functions of the old control. The techniques of operation and motor constructions have changed so that an entirely different system of control may be desirable.
3. To increase the power capacity of a particular machine, the control may have to be changed because the existing control capacity (contact rating) may not be sufficient to handle a larger motor. In the case where the contactor size is satisfactory the various protective devices must be checked.
4. Change in power system, for example, from d-c to a-c may involve changing the controls, the motors, or both.
5. A change in production system or routine may make it necessary to have the motor or motors started either from a remote point or automatically (viz. a pressure switch or limit switch). It may become necessary to provide controls that insure safety and proper sequencing of the motors to prevent breakdown in the production setup.

In studying the control picture as portrayed in TABLE 1, the realization that certain "building blocks" are available, that they fit into a particular pattern and that they bear an important relation to other components will pay dividends in any electrical control application. The chart can act as a road map in going from a source to a particular destination. Sometimes a newly discovered path may dictate a more convenient destination. Future articles will discuss details of the "block" items shown in TABLE 1 and will provide a better understanding of these components.

Fig. 9. (below) A third alternative control developed from Table 1.

Fig. 10 (right) Power circuit when using an a-c power source and a d-c motor.





Inexpensive Pictorial Plant Layout

By C. L. Fanning*
Asst. Chairman
Machine and Wood Shops
General Motors Institute
Flint, Mich.

Proposed changes in the arrangement of machines or other equipment have been shown in many ways, ranging from cardboard cutouts to wooden models. When cutouts are used, length and width are shown to scale but there is no indication of height. This layout may be sufficient for the placement of machines and, to the man accustomed to visualization from such a layout is all that need be made. Many to whom such a layout must be shown, however, are not familiar with interpreting three-dimensional space from two dimensions.

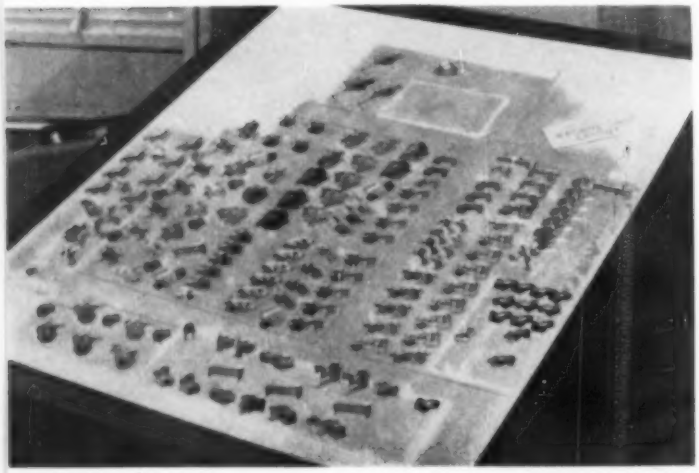
Wooden scale models offer the best solution to this layout problem but introduce a high cost. A photographic layout can do almost as good a job for only a fraction of the cost of wooden models.

In this system, pictures of each type of machine are taken from an elevated position at an angle of 45 degrees from the front. Using a reflex type camera with $2\frac{1}{4}$-inch square film, the desired size to match the $\frac{1}{4}$-inch per foot layout is controlled by distance and enlargement of the print. The film image size may be measured on the ground glass before taking the picture if it is possible to use contact prints. Duplicate pictures of a machine are thus available at a cost of about 6c each.

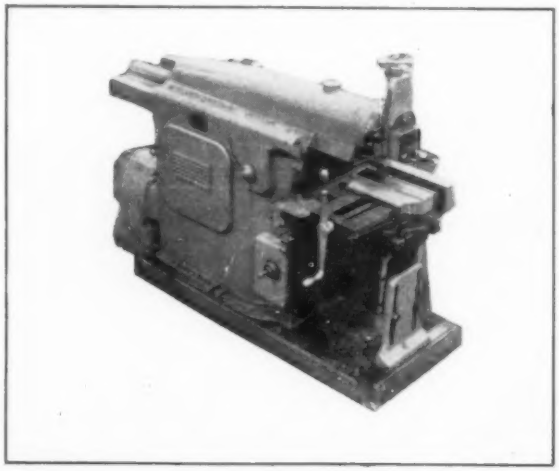
Each machine is cut out from the print and used as a movable piece during the planning stage. An individual machine can be cut out in about one minute. The completed layout can be used to familiarize employees with the proposed facilities, to check completeness of equipment and to assure efficient arrangement.

*Senior member ASTE Saginaw Valley chapter.

PHOTOGRAPHIC LAYOUT of a general machine shop, pattern shop and hydraulic laboratory can be used to check machine layout, spacing and placement. Materials handling flow patterns can be developed through use of such layouts.



SHAPER CUTOUT indicates the detail that can be obtained with this method of layout. Pictures are scaled on the camera ground glass before exposure to be sure they will be to scale.

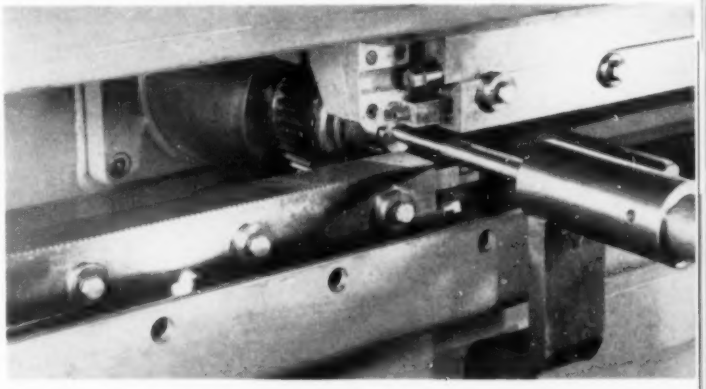


Cold-Rolled Splines save time and money

SPLINE ROLLING MACHINE forms splines, oil grooves, serrations and similar shapes on external surfaces. The machine is built on a rigid, welded steel C-frame and is powered by a 10-hp motor. Parts to be formed are positioned between centers so they are rotated by movement of the forming racks. Safety interlocks delay the work stroke until the workpiece is properly located between the head and thailstock, and prevent return of the forming racks until the formed part is removed. Design of the machine is such that workpieces can be automatically loaded and unloaded.

FORMING RACKS of the spline roller are about to engage the outside diameter of a workpiece. The spline being formed has helical teeth but straight splines can be produced by substituting different forming racks. Both tool racks have fine serrations, before the forming teeth, to start the workpiece rotating. The two slides holding the forming racks are mounted one above the other and move in opposite directions. The slides are coordinated by master driving racks and an idler gear. The lower rack is driven in each direction by separate hydraulic cylinders. Tool racks are adjusted toward the part center by sliding wedges to give correct size. Racks can also be adjusted endwise to obtain correct relationship with the part axis.

Tool racks are designed to press deeper into the workpiece as the working stroke progresses. A few additional workpiece turns are made at full depth to set the teeth. Tool racks are high-carbon high-chrome steel and are expected to have long service lives because all stresses are in compression. Present estimates indicate 200,000 pieces per sharpening and 600,000 pieces per tool. Tool racks are carefully designed and ground for accuracy of spacing, pressure angle and helix angle, and to conform to the rate at which the workpiece material can be moved.



Splines and similar external shapes are now being produced by cold rolling up to 30 times faster than with present methods, and have good surface finish, high torsional strength, high accuracy and no chip removal problem associated with their manufacture. Since metal is displaced rather than removed, in the new Roto-Flo spline roller developed by the Michigan Tool Co., Detroit, Mich., blanks are made to approximately pitch diameter before forming.

This production process leads to design flexibility because, through higher torsion load capacity, finer splines can now be specified. Also, teeth can be formed right up to a projecting shoulder without the necessity for a clearance recess. The shoulder is not damaged, and greater strength and better bearing surfaces result. Photomicrographs of sections cut through the cold-formed teeth show that the flow of metal conforms with the contour at the root of the teeth.

Parts have been successfully rolled from SAE 1037 steel ranging in hardness from annealed to 41 Rockwell C. Surface finish is measured at 3 to 6 microinches, rms, and accuracy is held within 0.0008-inch variation from part to part measured over pins.

Gap-Bed Turret Lathe Machines Offset Part

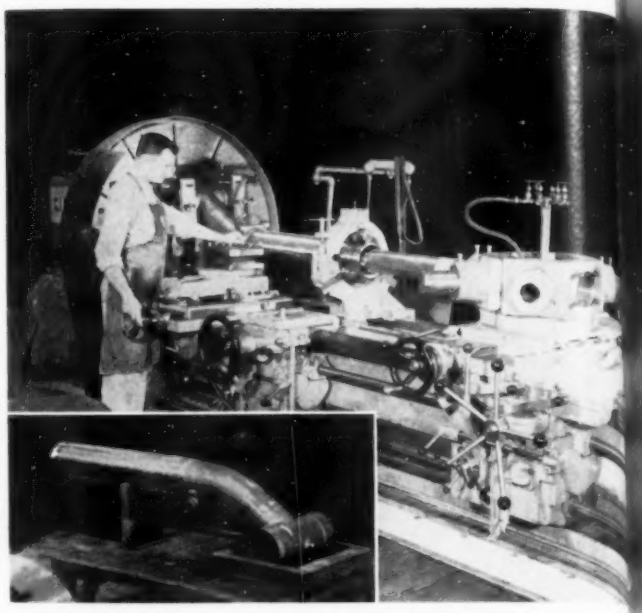
Heavy, odd-shaped aircraft landing gear components are now machined at high speeds on a special gap-bed turret lathe at the South Bend, Ind. plant of Bendix Products Div., Bendix Aviation Corp. An adaptation of a Gisholt Machine Co. 4L saddle type turret lathe, the machine turns and bores tubular

DESIGNED FOR PRODUCTION

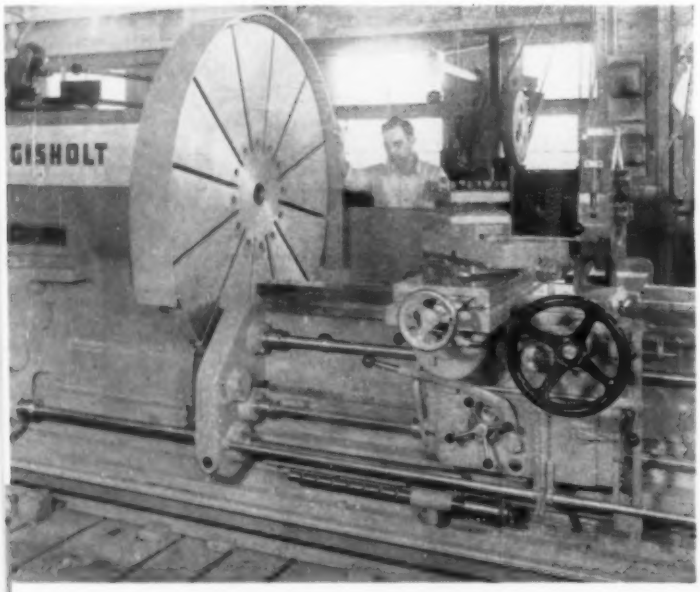
steel landing gear cylinders that have an angular offset at one end.

Rigidity of the frame of this lathe, together with adequate work and tool supports, flexibility in traverse and swing, and full control of speeds and feeds, permits machining at high rates with close dimensional control. The boring bar support has a 6-inch capacity.

The machine has shaft-lever controls mounted on the headstock for control of the spindle speed. Twelve speeds, from 7 to 183 rpm, are available. The spindle drive is powered by a 30-hp constant-speed electric motor. Sixteen power speeds on the hexagon turret provide for boring, facing and recessing operations. Maximum travel of the hexagon turret away from the spindle nose is 210 inches.

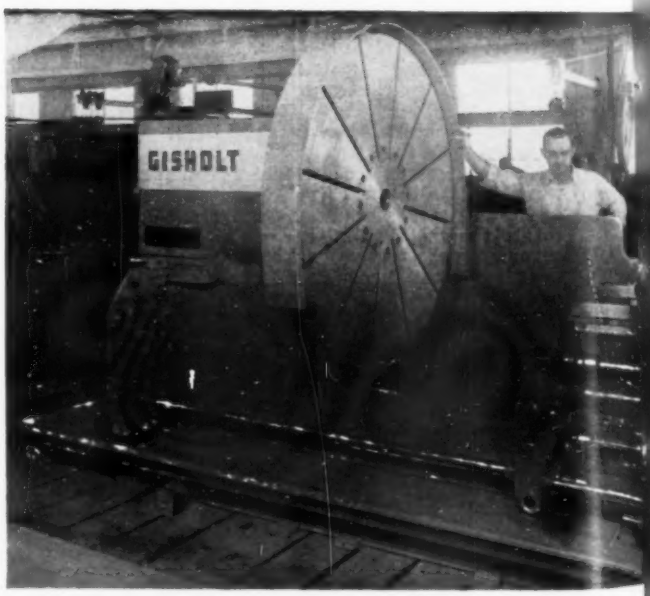


AFTER THE CYLINDER (inset) is located in its special fixture on the 6-foot faceplate, turning begins. Tools on the square turret finish the outside diameter while those on the cross-feeding hexagonal turret bore, face and recess the interior of the cylinder. Central coolant distributor on the hexagon turret supplies tooling coolant without conventional piping. An extra alloy steel bedway in the center of the frame supports the front of the 12½-inch capacity steadyrest, leaving the front bedway unobstructed for full travel of the square turret carriage. Each apron has a knock-out handle so the machine spindle can be stopped from either location.



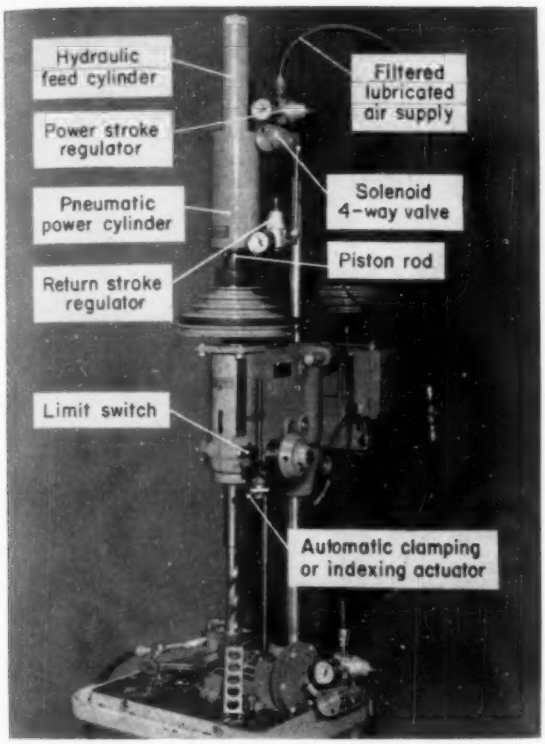
BED ASSEMBLY is power actuated by an electric motor and can be traversed close to the faceplate. Travel of the bed assembly permits tool to work to the end of the workpiece when necessary. The compound cross slide on the square turret has a left-hand carriage to permit the tool to work to the edge of the gap with a minimum overhang. For quick and easy control of longitudinal cuts, each carriage is equipped with individual feed controls.

OPEN GAP in the bed of this saddle type lathe permits handling of odd-shaped parts with swings up to 80 inches. Twelve T-slots in the faceplate facilitate chucking the special fixture required to hold the angular cylinder. The headstock and bed are fabricated from a single nickel-semisteel casting.



Drill Press Power Feed Saves Shop Air

By **A. L. Caplan***
Chief Engineer
The Pneuma-Draulic Co.
Detroit, Mich.



PRODUCTION CYCLE of this drill press is automatic after a momentary contact switch is depressed. The switch closes a relay, which holds the solenoid energized until the hole depth limit switch is tripped. The same momentary switch energizes another solenoid valve to actuate the air-operated workpiece vise. Rapid approach is made at impact hammer speed, then the drill is hydraulically fed to the correct depth. Repetitive accuracy is within 0.005 inch in hole depth. Use of a time delay unit, providing a momentary dwell against a mechanical stop, gives accuracies within 0.0005 inch. After the drill is withdrawn from the work, the workholding vise releases.

Since manually operated production drill presses represent a particularly good area for cost reduction, a new power feed attachment has recently been developed. Called the Rotafeed, this unit, on which patents are pending, was designed to give increased speed of production with lower air consumption.

The attachment is mounted over and directly in line with the drill spindle to avoid mechanical losses inherent in side-mounted rack and pinion types. With this design, the regular drill press handle is retained for setup and manual operation. In-line mounting required development of various flange adapters and column brackets to fit a variety of drill presses. The piston rod is so attached that the spindle can be advanced and positively retracted without tension springs or counterweights.

Because the piston rod is attached to the spindle, the rod must rotate. The end of the spindle is drilled and tapped to receive a threaded end of the piston rod. The other end of the rod is attached to a high thrust capacity ball bearing housed in the piston. A special air seal permits simultaneous rotation and reciprocation of the piston rod without leakage.

One of the design requirements was a large thrust capacity to permit normal drilling operations with 40-60 psi air. This requirement is met by using a slightly larger cylinder than necessary, which re-

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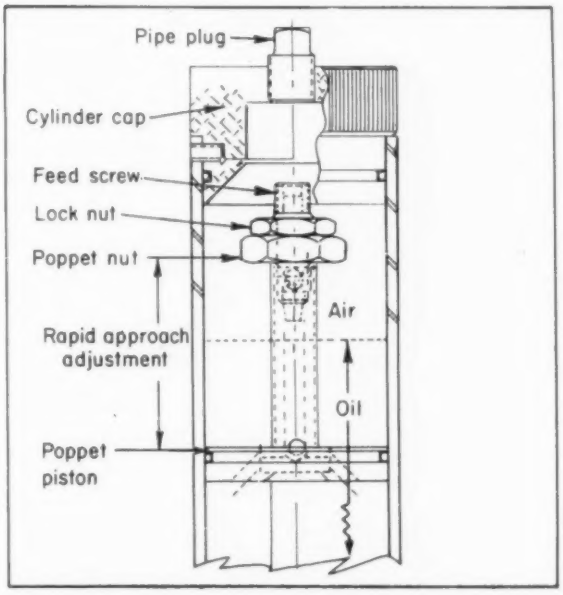


THE RAPID APPROACH stroke length is adjusted by removing the cylinder cap, loosening the lock nut and moving the poppet nut up or down on the threaded valve stem. The drill press handle is used to check for proper drill point clearance at the end of the approach stroke. The hydraulic feed adjustment is made by turning the feed screw clockwise or counterclockwise with a hexagon socket wrench.

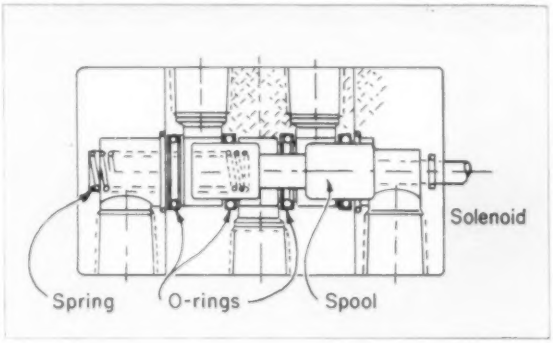
sults in reserve capacity for multiple spindle operations.

A problem inherent in air cylinders, the sudden surge when load is removed, such as when the drill point breaks through, is solved by the hydralic feed control unit mounted in line with the air cylinder. This unit has an air space above the oil, permitting constant venting of the fluid to atmosphere and preventing the possibility of trapped air in the system. This design avoids use of expansion and make-up oil chambers, and requires no special oil injection equipment. Action of the drill is: rapid approach to the work, hydraulically controlled feed through and instantaneous return. Drilling depth is controlled by a limit switch, mounted on the drill press stop lugs.

The hydraulic control unit is a poppet flow control valve giving controlled flow on the power stroke and free flow on return. The poppet valve stem has an integral, adjustable orifice that results in an infinite number of feed rates. On the return stroke, the shoulder on the stem engages the piston and fluid is instantly passed through four angular holes drilled in the piston. The stem is positively assembled to the air cylinder piston, which does not rotate.

Individual pressure regulators at each cylinder port reduce the over-all consumption of air. Return stroke of the unit is effected by 10-15 psi air, which results in low consumption and a reduction in compressor load and wear. The rapid approach and return of the drill results in more drilled holes per hour.

A COMPACT SOLENOID 4-way valve for in-line mounting was not commercially available so one was developed. Having a cylindrical body, the valve is a solenoid-operated spring-return spool type. Being mounted in O-rings, the spool is full floating without metal-to-metal contact. The O-rings constantly lap the spool surface, resulting in long, leakproof service. The body and spool are machined from aluminum bar stock. Oversize exhaust ports permit instantaneous dissipation of pressure. To avoid piping problems and an operating time lag between the valve and the cylinder, the valve is mounted directly on the power stroke part of the cylinder.



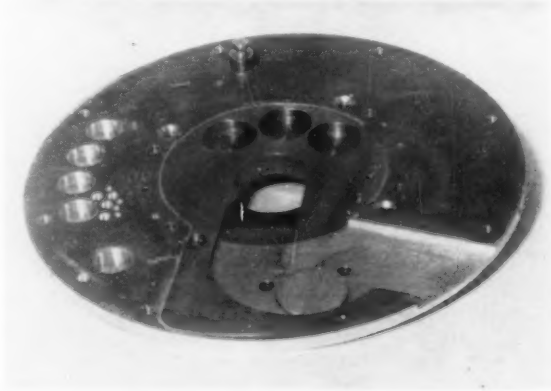
High-Speed Weighing—New Inspection Technique

A fully automatic machine for weighing coins, sorts 13,000 per hour with an accuracy of 0.25 percent. Developed by the National Bureau of Standards, the machine weighs coins by measuring the unbalance imparted to a rapidly rotating flywheel when a new coin is balanced against a standard weight.

The system is essentially a pendulum consisting of the flywheel mounted on the lower end of a rotating shaft. At the speed used, unbalance causes the center of gravity of the wheel to shift, with a magnification of 500 times.

Within six revolutions, the initial disturbance from loading a new coin is damped out. The detection of the constant amplitude of vibration that determines the difference in weight is made during the following two revolutions. A sensitive transducer detects the vibration of the pendulum shaft and, through electronic circuitry, times the injection of the next cain so the weighted one will be ejected to the correct container.

COIN WEIGHING FLYWHEEL, with top cover removed, compares weight of new coin to a standard weight in background. An unweighed coin is injected vertically from under the hole in the central hub while the wheel rotates at 3,000 rpm. Centrifugal force moves the coin from the hole to the weighing pocket. The new coin imparts its momentum to the weighed coin, forcing it off the wheel through the slot and into the correct "accept" or "reject" chute.



tooling for
injection molded nylon gears

By Louis D. Martin

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WHILE INJECTION MOLDED NYLON GEARS have been made and used for at least a decade, they have been regarded with a mixture of curiosity and skepticism by many engineers. When some of the more progressive and farsighted molding companies demonstrated what could be done with properly molded nylon gears about five years ago, their use expanded at an unprecedented rate. Dramatic savings and functional improvements are constantly being reported for products using injection molded nylon gears. Such gears, *Fig.* 1, range from small, lightly loaded clock parts to highly stressed washing machine gears.

Properties of Nylon

Nylon, especially grade FM-10001 which is best for gears, has valuable properties as a gear material. Nylon gears require no lubricant for light loads at high speeds or moderate loads at low speeds. This is especially important in applications where oil stains would be objectionable or in household appliances where lubrication might be neglected. Nylon has a low coefficient of friction; against polished steel the coefficient is less than 0.15. Its dynamic frictional coefficient varies depending on the conditions of operation. Where the application is satisfactory for long life, measured coefficients range from 0.20 to as low as 0.04.

Nylon has the ability to yield to a more rigid material and conform to its shape. Because of this property, nylon gear teeth can reduce tooth spacing error effects of the mating gear and result in better conjugate action. This leads to smooth, quiet operation and long service life. These benefits can only be achieved in the presence of loads sufficiently large to cause deflection in the nylon teeth. Because of their compliability, nylon gears can be specified with greater tolerances than similar metal gears and give equivalent results.

Nylon gears operate well with other nylon gears but their best wear is obtained when they mesh with hardened steel gears. This is undoubtedly due to the compliance induced by the more rigid steel and the favorable coefficient of friction. However, nylon does not wear as well when operating with brass gears as when operating with steel or nylon because brass and nylon are incompatible. Some bronzes work better with nylon than does brass but they

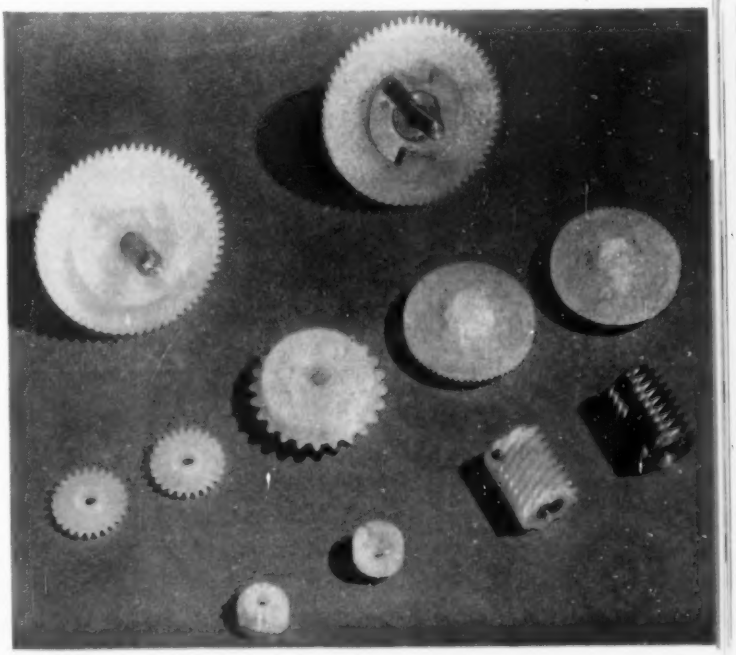
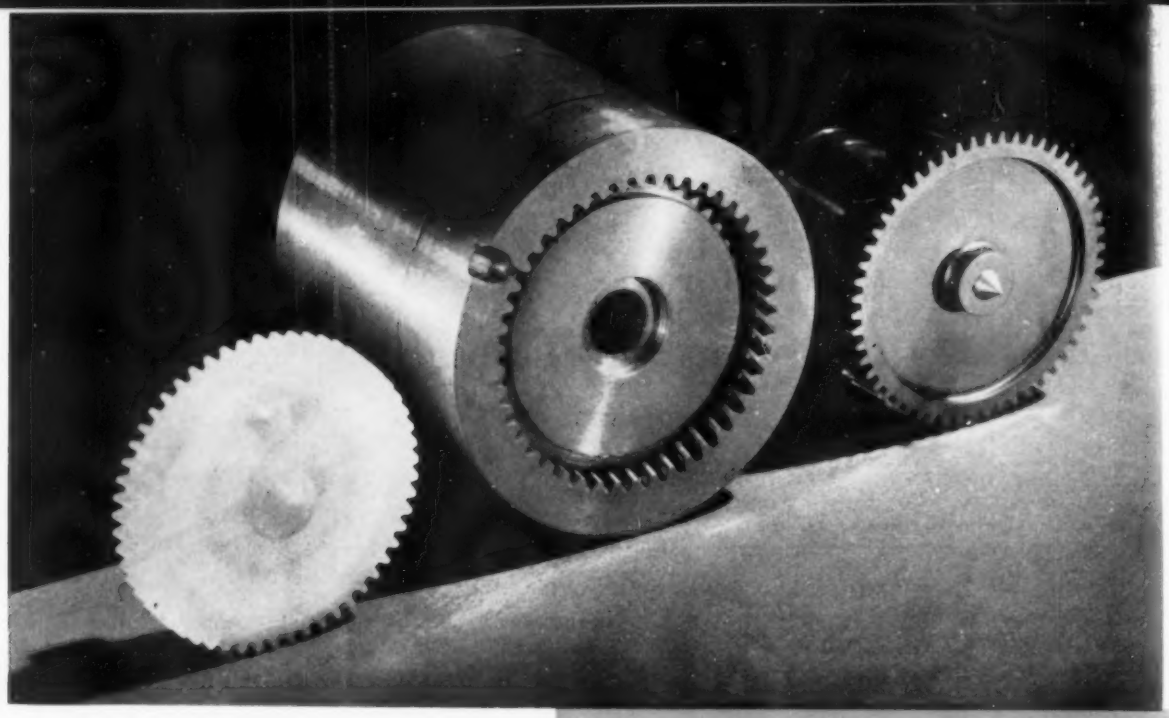


Fig. 1. Typical injection molded gears showing use of metallic inserts and combination of functional components. Nylon worm with brass insert, at right, was produced for 1/15 the cost of the equivalent steel worm next to it.



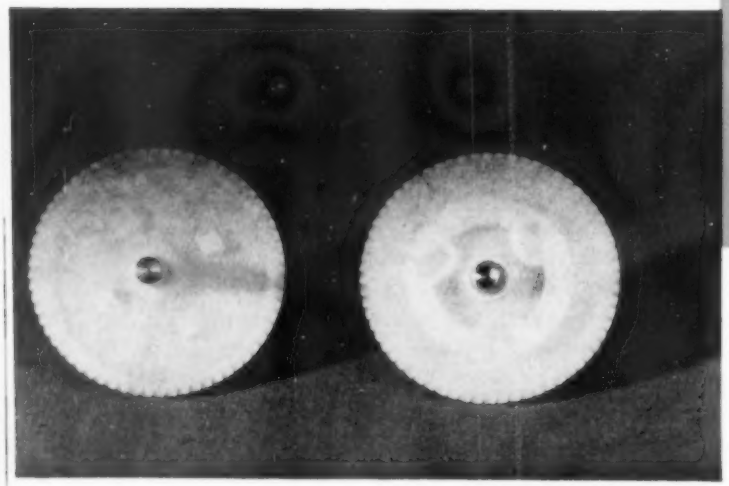


Fig. 2. (left) Shrinkage of gear on right is much greater than that of gear on left because of the added mass in the web.

Fig. 3. (above) From left to right: an injection molded nylon gear, the beryllium copper mold in which it was made and the steel "force" about which the mold was cast.

cannot equal the performance of steel and nylon combinations.

In the early days of injection molding of nylon gears, nylon was recognized as having properties that are peculiarly desirable in gearing. All that was required, many molders thought, was to mill teeth in a piece of tool steel, harden it and press it into a block of steel to make a cavity for a helical gear. Even the most fundamental principles of gearing were ignored.

It is common knowledge, for instance, that rotary range milling cutters produce at best a compromise profile. Many molders used a spur gear cutter to produce a helical punch. The fact that they were not producing an involute curve in the plane of rotation never entered their minds. The idea of sinking a helical punch into a block of steel to produce a cavity is a hangover from mold making techniques of simple mechanical components where a hob or "force" was used to produce a cavity.

As a result of lack of knowledge of gear geometry by the plastic pioneers, poor nylon gears were produced. As an example, a large company suffered considerable loss in one of its appliance divisions because of poorly conceived and tooled injection molded gears. Prejudices were created within this division and permeated other branches of the company. It took years for better equipped and staffed plastics companies to break down this resistance.

Limitations: The engineer who is contemplating use of injection molded nylon gears should know the limitations as well as the desirable features of the material. To realize the fullest advantages of nylon, close cooperation between the molder and the design engineer is desirable. It often happens that the molder can and does make valuable design suggestions to adapt a contemplated part to injection molding. In addition to the many geometric considerations of tooth profiles, as with metal gears, consideration must also be given to molding variables. Molding companies are best able to predict what the mold shrinkage of a given gear is going to be and thus make proper allowances in the mold.

Among the variables that affect the over-all shrinkage of a molded nylon gear are: size and type of molding machine, size and shape of molded

rticle, flow pattern of the plastic in the mold, sizes of the sprue and nozzle, molding cycle, condition of molding pellets, temperatures of the cylinder and mold, and the difference between thermal coefficients of steel and beryllium copper, when a beryllium copper cavity is used. In addition to gear shrinkage after molding, the variables also affect magnitudes of residual stresses set up in gears.

The molding engineer must be able to evaluate the influence of all of these variables on the final size of the gears. Having determined this from past experience, he must then confer with the gear engineer to determine the mold corrections that must be made so tooth shape, pitch and helix angle will meet drawing specifications.

An example of the consideration that must be given to mold shrinkage is shown in *Fig.* 2. The gears are identical with the exception that the one on the left has four detents while the one on the right has a cylindrical section with three angular depressions. Both of these gears engage the same worm. It was necessary to make the cavity for the right-hand gear 0.013 inch larger to obtain the same size after molding. The additional mass of the cylindrical section might appear inconsequential but it is sufficient to cause this difference in shrinkage. It can be seen that shinkage variables do not conform to simple mathematical relationships.

Injection Mold Cavities

Each of the several methods of producing injection mold cavities is governed by the anticipated production volume and other limiting factors. The same geometrical considerations apply with each method. One method, which is currently popular, has many advantages over other methods.

In production of cavities by this method, a force or toothed punch, *Fig.* 3, is made of steel having an analysis of: 0.40 carbon. 0.05 chromium and 0.03 molybdenum. It is heat treated to Rockwell 56-58 C. The force is used as a core and molten beryllium copper is cast around it. The force will not lose its hardness at the casting temperature.

Since there is a difference in thermal expansion coefficients of 0.002 inch per inch between steel and the copper alloy, the force must be extracted from the cavity before they cool to room temperature. Corrections to anticipate shrinkage have to be made in the force. This example will be used to examine the corrections necessary to result in production of gears to specifications.

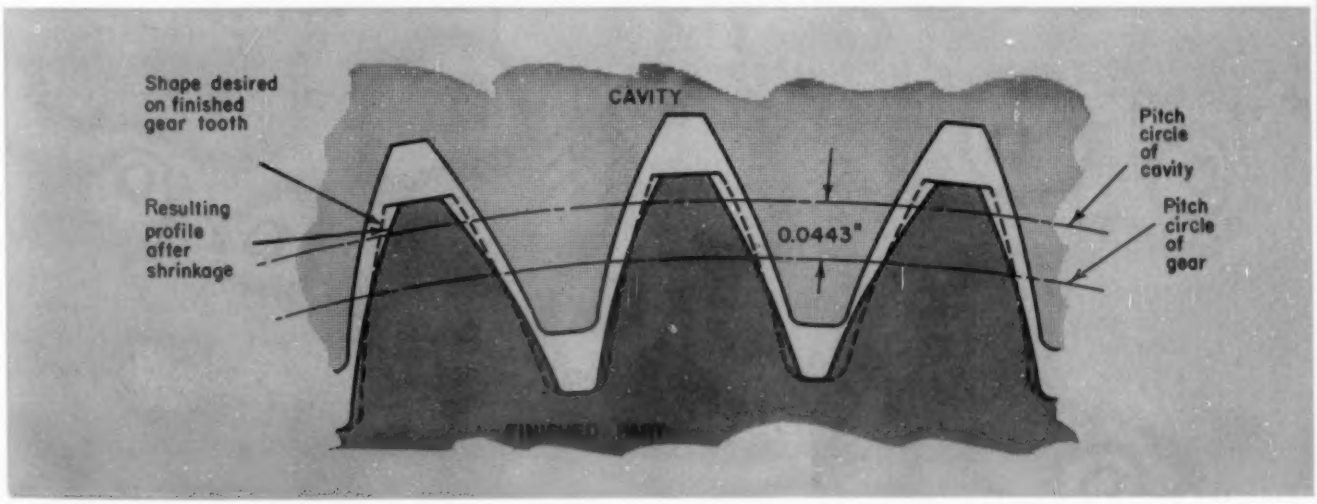
The dimensions of the gear and force of *Fig.* 3 are as follows:

Data of Finished Gear	Force Data
Number of teeth, 54	———
Normal diametral pitch, 20	———
Transverse pitch, 19.8054	———
Normal pressure angle, 20°	———
Trans pressure angle, 20° 11′	———
Helix angle, left hand, 8°	———
Std pitch diam, 2.7266″	Enlarged pitch diam, 2.8152″
Outside diameter, 2.826″	Outside diameter, 2.9178″
Reduction in tooth thickness, 0.001″	———

The dimensions of the force are corrected for a shrinkage allowance of 0.0325 inch per inch. This allowance includes mold shrinkage, diameter reduction due to heat treatment after molding and beryllium copper shrinkage.

The vast majority of cavities are produced with standard tools and conjugate action is not possible with the gears produced. *Fig.* 4 shows what happens when the force used to produce the cavity is generated with a standard gear generating hob. The profile labelled "cavity" is the shape that would have been produced on the force with a standard gear generating hob. The pitch line of the cavity is displaced

Fig. 4. Illustration of unsatisfactory results obtained by producing cavity from a force on which teeth were formed by a standard gear generating hob.



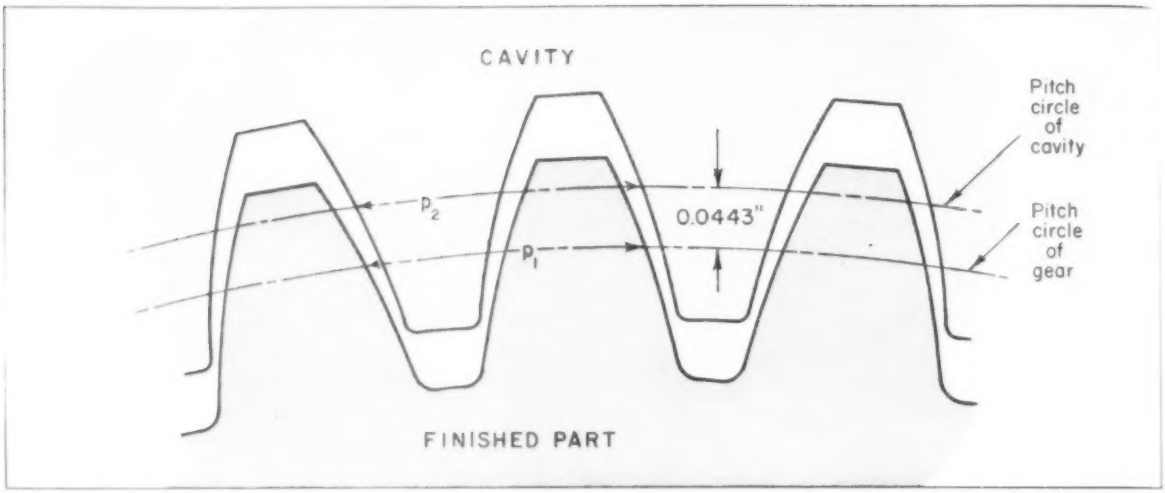


Fig. 5. Circular pitch of the force generating hob must be greater than that for the molded gear to accurately allow for shrinkage.

0.0443 inch from that of the finished gear. When a standard gear generating cutter of a given pitch and pressure angle is used to generate an oversize gear, the profile shape is different than that of a standard gear because a different portion of the involute curve is used as a profile.

While it is perfectly possible and commonplace to operate enlarged gears together and still obtain conjugate action, the conditions prevailing in a force are different. When two enlarged gears are generated by the same cutter, their base pitch and pressure angle are equal, which is a fundamental requirement for conjugate action. In a mold force, however, the shape produced on the force is not the one transferred to the work because of the shrinkage, which in this case is 0.0443 inch in a radial direction.

If the profile of the cavity is caused to contract an amount equal to shrinkage in the nylon, its circular pitch is smaller and consequently the profile shape is not correct. The profile change is shown by the difference between the heavy and dotted lines in *Fig.* 4. The desired profile is shown dotted while the resulting profile is shown by the heavy line that is identical to that of the cavity. This shows an increase in the apparent pressure angle of the shape produced by using a standard generating hob on the cavity force.

The pressure angle that should be put on the force generating tool to approximate the desired shape can be computed from the following equation:

$$\phi_t = \cos^{-1}\left(\frac{D_c \cos \phi_D}{D}\right)$$

where

ϕ_t = Transverse pressure angle desired on tool
D_c = Enlarged pitch diameter for computed shrinkage
ϕ_D = Transverse pressure angle at D
D = Standard pitch diameter, (N/P)
N = Number of teeth
P = Diametrical pitch

For this example, computations would be:

$$\phi_t = \cos^{-1}\left(\frac{2.8152 \cos 20^\circ 11'}{2.7266}\right) = 14^\circ 17'$$

If a gear generating hob has a normal pressure angle of 14° 17′ instead of 20°, the profile shape generated on the force would impart a more nearly correct profile to the shrunken part. The difference in pressure angle of 5° 54′ amounts to a profile error of approximately 0.010 nich on a working depth of 0.100 inch. This amount of profile error cannot be tolerated except in low-grade gearing.

The equation is admittedly an approximation because it uses as a basis the departure from its true position of a straight line normal to the line of action at the pitch point. The equation is therefore more accurate where the profile curvature of the gear is flat, or large, such as with gears with a large number of teeth, than in pinions. It gives satisfactory results for all practical purposes and is quick to use.

In order to produce gears to specification, the profile produced in the cavity must shrink to that of the desired part. To achieve this condition, a special gear-generating hob is required. The circular pitch of this hob will have to be greater than that of the finished gear, *Fig.* 5. The distance p_2 on the pitch line of the cavity is greater than p_1 on the pitch line of the gear. To obtain profile similarity between the gear and the cavity, all elements of the gear must be enlarged at the proper shrinkage rate. In the example under consideration, it is only necessary to compute the diametral pitch of the hob to be used for generating teeth on the force. This can be simply done with the following equation:

$$P_n = \frac{N}{(D + \Delta D) \cos \Psi}$$

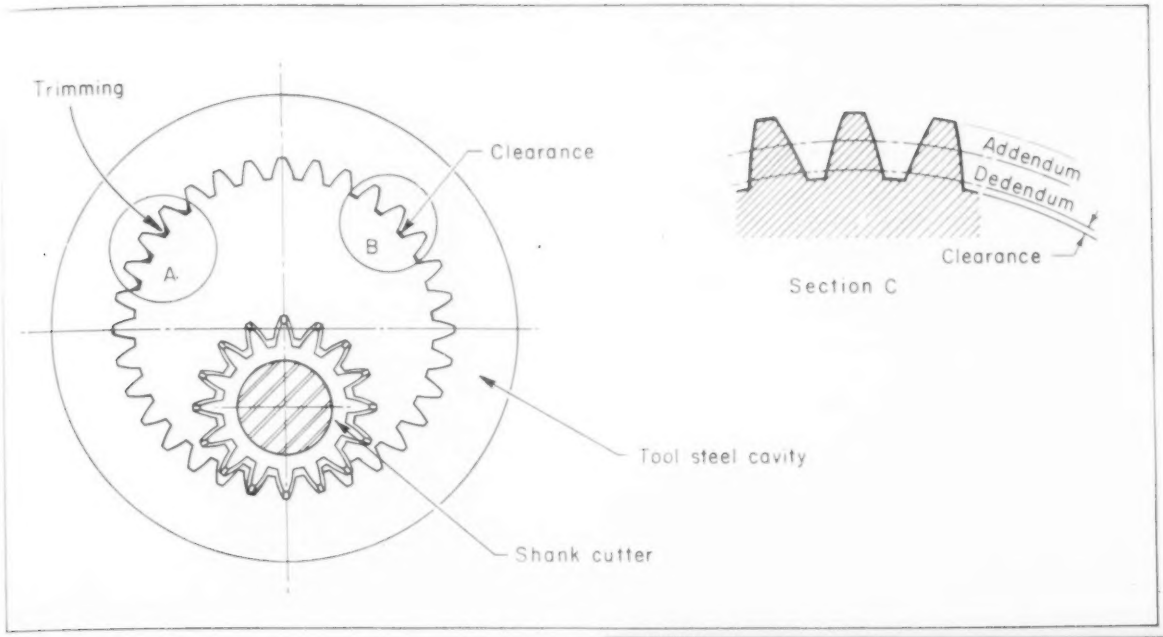


Fig. 6 (above) When producing a cavity on a gear shaper, an oversize cutter will cause trimming, as at A. A correct cutter makes allowance for clearance as at B. Section C illustrates a fragment of an external gear made in a cavity produced as a modified internal gear.

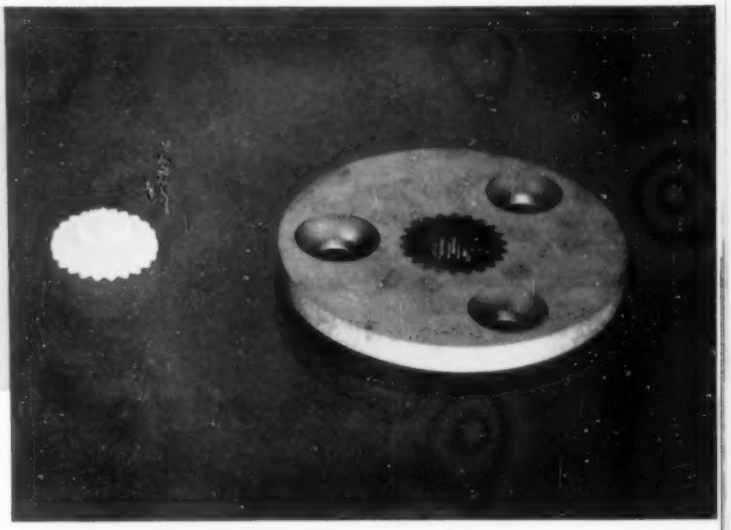


Fig. 7. (right) Ultrasonic techniques are used to form molds in tungsten carbide, such as the one for the two-gear cluster shown.

where

P_n = Normal diametral pitch of hob
N = Number of teeth
D = Standard pitch diameter of finished gear
ΔD = Change in standard pitch diameter
Ψ = Helix angle

For the example under consideration:

$$P_n = \frac{54}{(2.7266 + 0.0886)\ 0.99927} = 19.37$$

A Second Method: Another method for producing cavities is illustrated in *Fig.* 6. In this method the cavity is made of tool steel and internal teeth are generated by means of a reciprocating gear shaper cutter. When gears of relatively narrow face widths are required, they can often be made in multiples.

There are a number of limitations to this process for producing cavities. The ratio between the size of the cutter and the diameter of the gear is one limitation. When the cutter diameter approximates two-thirds of the diameter of the cavity (varies with pitch and pressure angle) trimming of the teeth at their minor diameter occurs as shown in inset A. *Fig.* 6. This trimming is aggravated by the fact that the internally cut teeth are somewhat different than an internal gear used for motion or power transmission. The minor diameter of an internal gear can extend up to the base diameter where the tooth profiles originate. Any diameter smaller than this would cause interference. A cavity generated like an internal gear, used to mold an external gear, must be proportioned differently. Its minor diameter must be somewhat smaller than that of an internal gear because it must make provision for clearance at the root of the tooth of the external gear it will produce. This is shown in inset B and in the section C showing external teeth produced by the cavity.

A Third Method: Another method of producing cavities uses ultrasonic energy and a formed punch to sink a shape into tungsten carbide, *Fig.* 7.

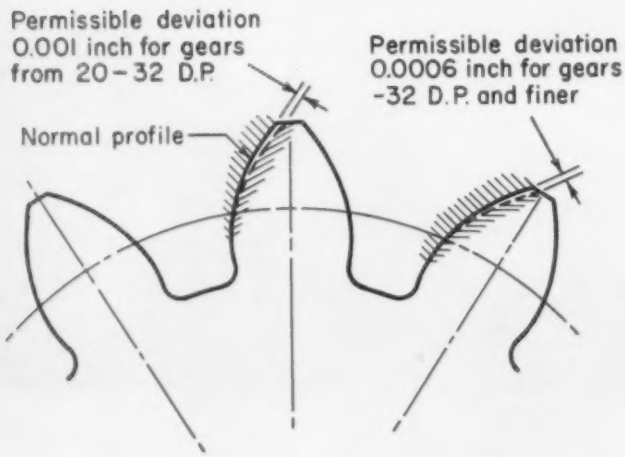
The punch, preferably drill rod hardened to 35-38 Rockwell C, is reciprocated at speeds up to 30,000 cps with amplitudes of from 0.002 to 0.020 inch. As the punch is lowered into the blank, it is flooded by a boron carbide abrasive slurry.

The punch usually has a pilot to keep it centered and is made smaller than the desired cavity. The punch cuts slightly large because of the abrasive surrounding it. Cutting action is fast and surface finishes of 3 microinches rms can be obtained.

In each of these three diverse methods of producing cavities, special tooling is required and must be carefully engineered and corrected for the required shrinkage.

When helicoids are molded (worms and helical gears) shrinkage changes occur in lead and helix angle which must be carefully evaluated and compensated for in order to obtain satisfactory tooth action. Only an expert can predict the necessary corrections.

Fig. 8. Permissible profile errors for gears of various diametral pitches, showing the correct manner of indicating them.



Gear Specification

Many engineers expect too much of nylon gear and put tolerances on drawings that are impractical and unrealistic. Because of inherent compliability, nylon gears can be set up tightly and operate satisfactorily with a slight interference if they are not overloaded to generate heat. Profile tolerances, especially on gears that carry an appreciable load, can usually be broader than equivalent metal gears. This is also true of other types of errors, such as pitch error runout and lead error. A good guide is to use the next lower class than that specified in American Standard Inspection of Fine Pitch Gears, B6.11-1951. If a Commercial Class 4 gear would be satisfactory if made of metal, then a Commercial 3 gear made of nylon should operate satisfactorily.

Suggested tolerances on profile shape for various pitches of gears are shown in *Fig.* 8. The manner in which these tolerances are indicated shows how to specify them in a realistic manner. Deviations from the nominal gear tooth profile falling inside of the theoretical shape are more desirable than those outside. In the latter case, interference may develop while in the former, smooth tooth action will result.

Cost and Performance

Injection molded nylon gears may cost anywhere from 1/6 to 1/20 as much as equivalent metal gears. Much depends on what other components—cams, splines, ratchets, etc.—are combined with the gears. When several gears can be molded as a cluster, savings are appreciable.

In step with the increased production data now available, current studies are investigating the load-carrying capacities of nylon gears. This information on endurance should be available soon and will give engineers authoritative data in evaluating this useful gear material.

Multiple Inspection Simplified

CHECKING of eleven groove locations in a cylindrical hydraulic valve part necessitated unusual and time consuming inspection methods until this novel device was instituted.

A precision turntable was devised and equipped with eleven dial indicators mounted on the periphery at heights corresponding with groove locations. As the table turns, indicators bear on each surface successively. The device served further to cut inspection time drastically.

Inspection and checking of eleven groove locations in a cylindrical hydraulic valve part necessitated unusual and time consuming methods until this novel method was instituted.

cam-actuated dies promote economy

By Arthur J. Stockwell*
Assistant Supervisor
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Minneapolis-Honeywell Regulator Co.
Minneapolis, Minn.

PRODUCTION ADVANTAGES and savings can be obtained by the use of cams in complex dies. Cam-actuated dies make possible the combination of several operations in one press stroke, thereby lessening the number of dies necessary to produce a given part. In addition to requiring fewer presses, die handling costs are reduced and less die storage space is required. Because cams can be actuated by short press strokes output per press is increased.

Adjustments can be made on cam-actuated dies to accommodate stock that varies in thickness, which is not possible on camless dies. Although initial costs are higher than for conventional dies, reasonably high runs make their use financially worthwhile.

Minneapolis-Honeywell Regulator Co. has successfully designed and adapted simple circular and semicircular cams for dies stamping precision regulator parts. Compact, strong and easily made, these cams, *Fig.* 1, can be any convenient thickness and diameter depending on the job to be performed. Little space is required to fit cams into a die shoe.

Some dies use both circular and conventional cams, in which two 45-deg surfaces come in contact when the die is closed, *Fig.* 2. Round cams are cut from tool steel plate with the steel grain parallel with the diameter for long wear and toughness. A hole is drilled through the center of the plate to accommodate an arbor necessary for turning down a convex radius around the circumference. Disk is then divided by sawing across the diameter, producing two semicircular cam rockers. Cams other than semicircular are made in the same manner.

A bearing surface, *Fig.* 2, in which the came rocks, is die milled (cherried) into the shoe surface. Sinking cam recesses below the working surface of the shoe in this manner helps relieve the congestion of parts on shoes. The recess is not deep enough to weaken the shoe.

One adaptation of circular cams, *Fig.* 2, makes possible ten operations in one die. In one stroke, this die pierces six holes in thermostat covers, blanks out an end opening and impresses three dimples. Cam B locks with M before P dimples the cover. Cam B is released by part movement and gravity during punch disengagement, allowing part ejection by air.

Although dies can function well without cams, cams can do much to increase output. Movable form pads, *Fig.* 1-A, are motivated by cams which allow the stock strip to remain at die level without requiring lifting over a forming recess for movement to the next station. On shut position, the pins force rocker cams upward. Spring action lowers the pad when the ram rises.

Short strokes, typical of Diebel presses, have the disadvantages of limiting die shut height and hin-

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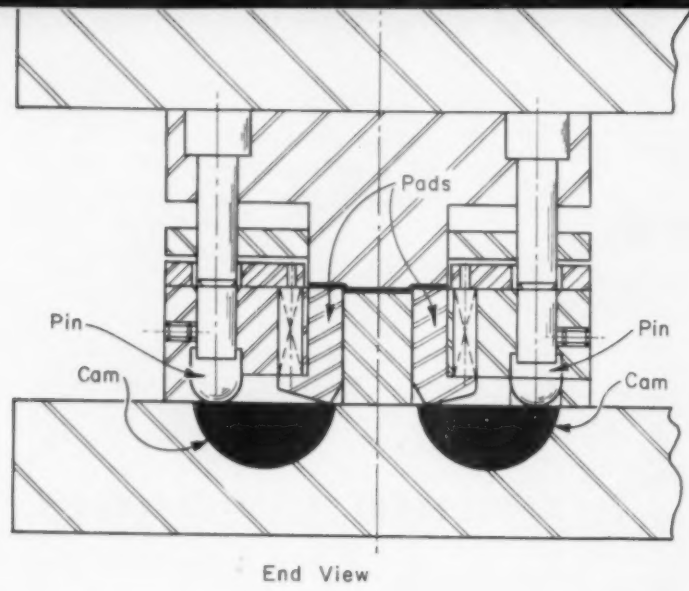


Fig. 1. Portion of progressive die showing actuating pins and semi-circular cams seated in milled pockets in the shoe.

dering high-speed ejection of parts. Circular cams have counteracted these restrictions by loosening the part from beneath, *Fig.* 3, increasing ejection speeds. Narrow Diebel press bed widths influence die sizes. Dies must be narrow enough to slide into the confined area between press posts. Before adoption of circular cams at Minneapolis-Honeywell, it was common to run dies in large, slow presses.

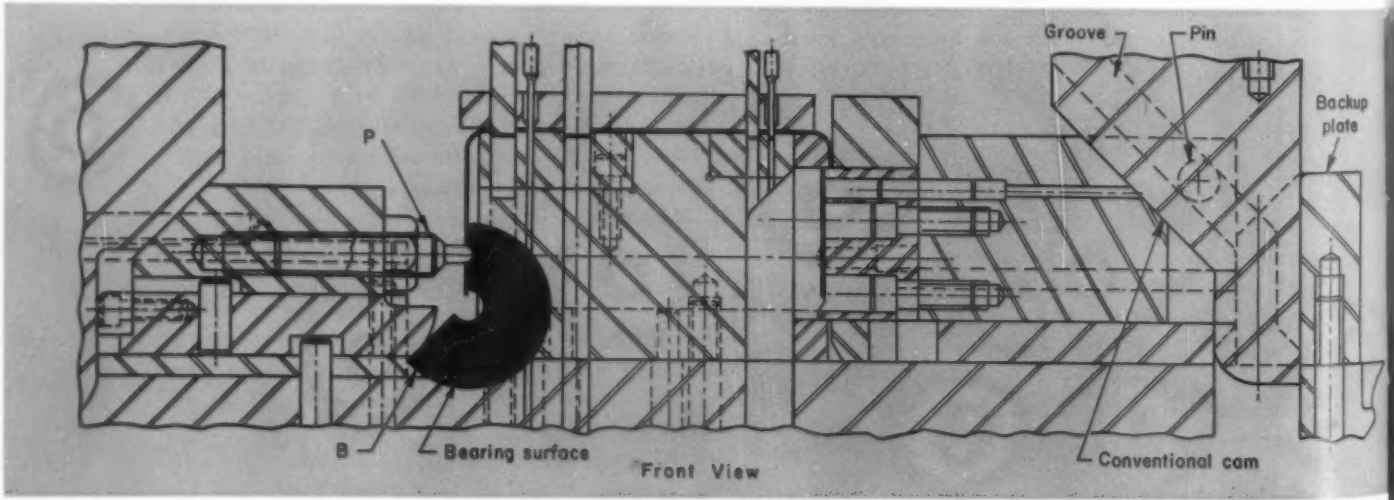
Difficult hole alignment in 0.032-inch brass switch parts is accurately performed in a cam die, *Fig.* 4. Pierced holes, 0.029 inch in diameter, are located 0.031 inch from a 90-deg bend. Two Lempco type die set pin and ball bushing assemblies accurately guide and contain the perforating punch. Previously, common beveled upper and lower sliding cams with gibs were used. Wear of slides, however, forced punches off center. Long wear and good punch alignment have resulted from use of the ball-bearing pin and bushing sets. Punches maintain an interference fit in the punch guide block because balls are elastic and become slightly oval under pressure. Ram action of ball bushing assembly is actuated by a bell-crank type of cam, C. At closed position, cam is actuated by adjustable rods.

To avoid galling of circular cams and conventional type beveled upper and lower cams, sliding die surfaces should be parallel and matched. Without these precautions, reduced contact area will result and cause high loading. All sliding surfaces should be clean and smooth.

Use of aluminum-bronze wear plates under conventional cam slides helps to resist wear by providing a good bearing surface and absorbing impact. Dowel pin holes in tool steel wear plates must be jig-ground to prevent shifting of cam assemblies. Aluminum-bronze plates can be drilled and reamed in line with cam gibs during assembly, saving tooling costs.

It is not safe practice to depend entirely on spring pressure for retracting conventional cam slides.

Fig. 2. Section of die that multipierces thermostat covers uses both circular and conventional 45-deg. angle cams.



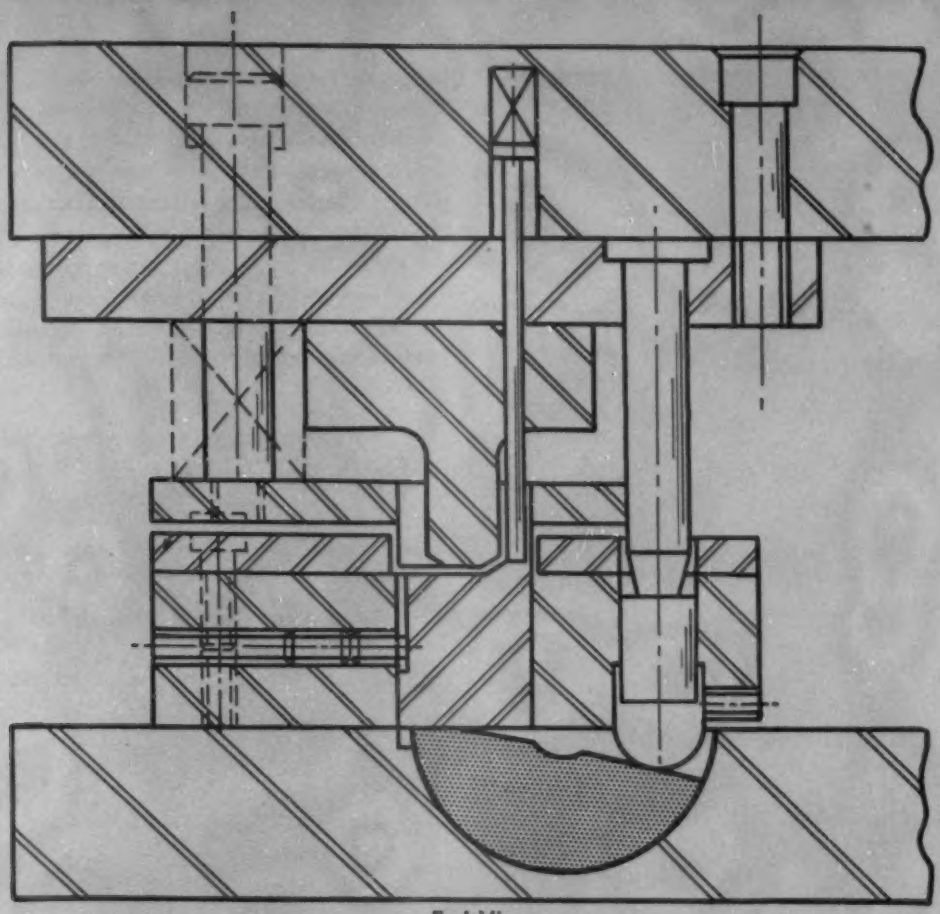
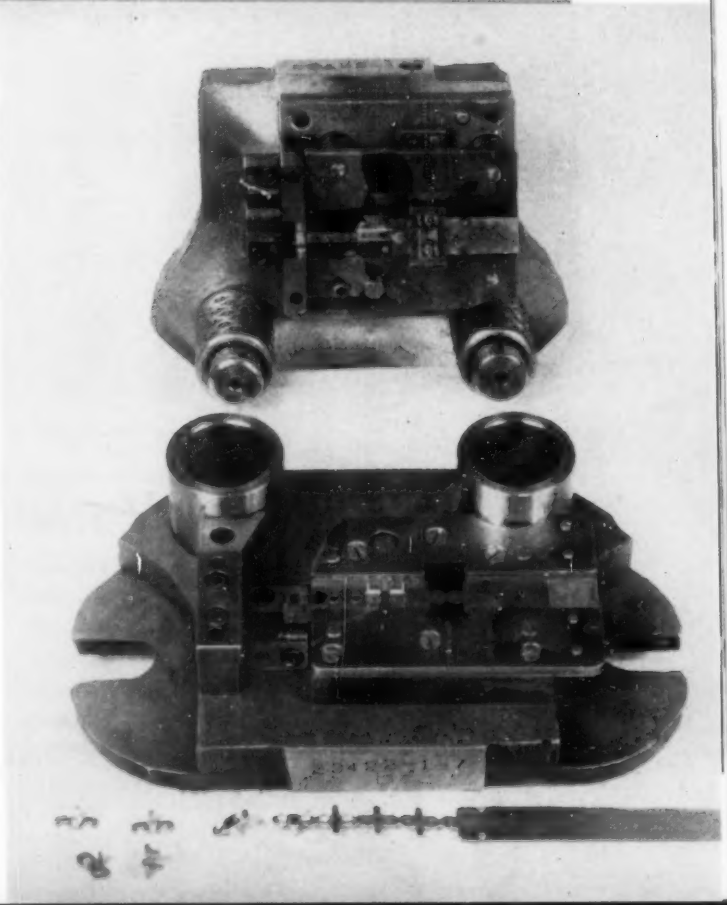


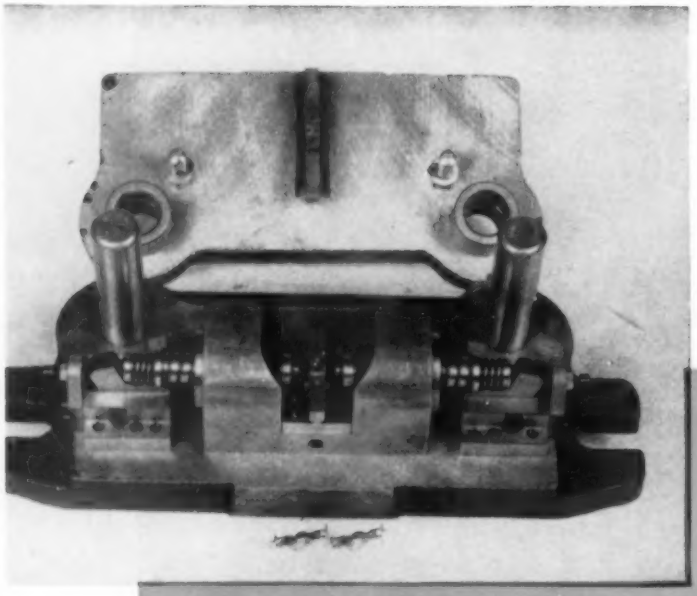
Fig. 3. Progressive die for making terminal clips. Semicircular cam aids part ejection in short (¾-inch) stroke Diebel press. Photo (below) shows die, finished parts and various stages in part manufacture.

Slides not in proper position when die is closed might cause a smash. Where design permits, a groove should be cut in the cam actuator, *Fig.* 2. A round pin, *Fig.* 2, protrudes from the lower sliding cam. Inserted in the groove, this pin forces the cam actuator back to starting position when the ram descends. Pin-groove combinations are positive, assuring slide return in the event of spring failure. Bolts and dowel pins usually are not sufficient protection against movement of actuating cams under load. Backup plates, *Fig.* 2, give positive alignment. Shifting of cams under pressure causes galling of wearing surfaces, part inaccuracy and accelerated wear of cams.

Secure clamping of parts being formed is necessary to avoid breaking and shearing of punches. Spring pressure on the part or a tight-fitting straddle block prevents stock shifting while being pierced. Moving parts should be shielded to prevent smashes if slugs eject through the top side of the shoe or if parts are not properly blown into a chute.

Cam angles should be calculated to give as little side thrust as possible. A 30 to 35-deg angle is

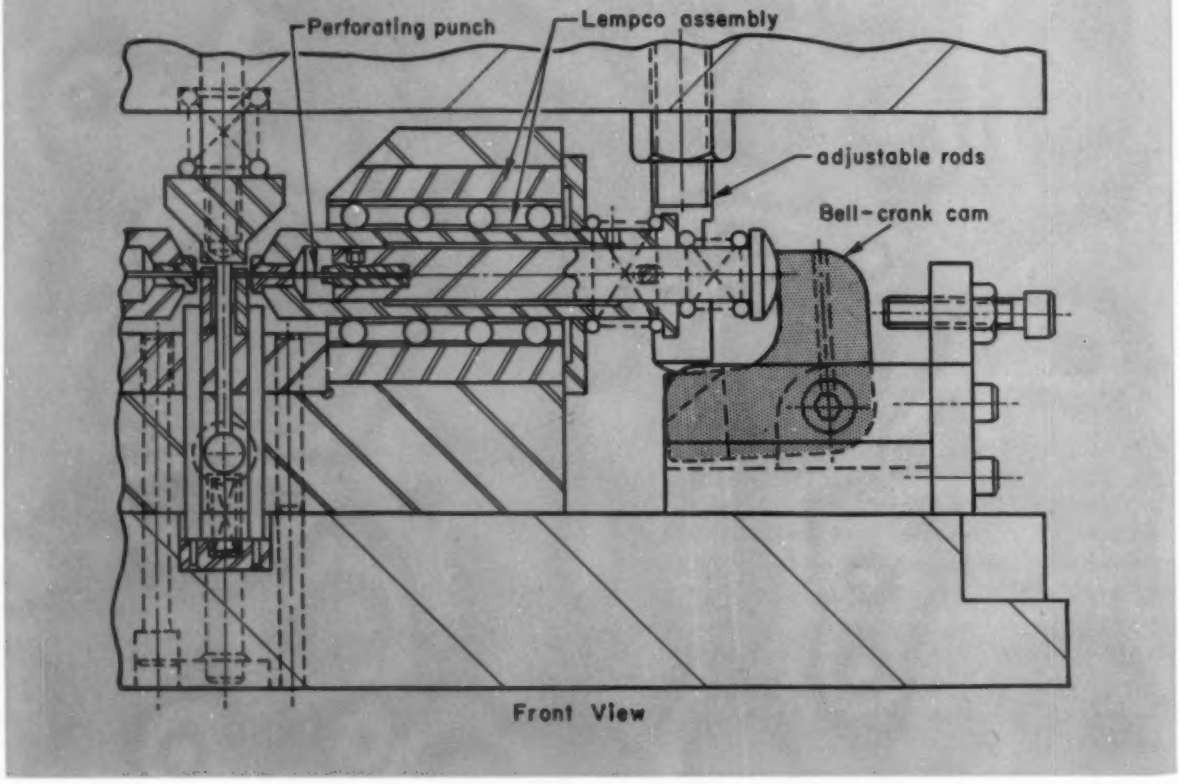




best. In most cases, however, the die has a specified amount of work to do within a definite press stroke, which limits the choice of angle. Use of a longer stroke press to attain better cam angles is folly if it slows production. It is better to maintain production rates by backing up the actuating cam.

Cam-actuated dies equal the accuracy of conventional dies and have the added advantages of compactness and versatility. Care in design, construction and maintenance will yield high manufacturing dividends.

Fig. 4. Section view of pierce die. Thin punches are actuated by simple cam and rod arrangement. Photo (upper left) shows assembled die with finished parts. This die is symmetrical with only one-half shown.



Bend Steel to Shape Ships

STEEL PLATE many inches thick is bent to ship keel and hull contours with the monstrous press recently completely by Clearing Machine Corp.

A 20-ft walking beam, which can exert a total of 1800 tons vertically and can also rock on a central axis, makes this press different from conventional machines. Pivoting of the beam in a pair of guided slides, thus permitting horizontal movement to left or right of center, enables the operator to hold pressure on one end, while lowering the other end of the beam, effecting a rolling action of the moving beam die over the work.

Lathe Drive

gives constant cutting speed

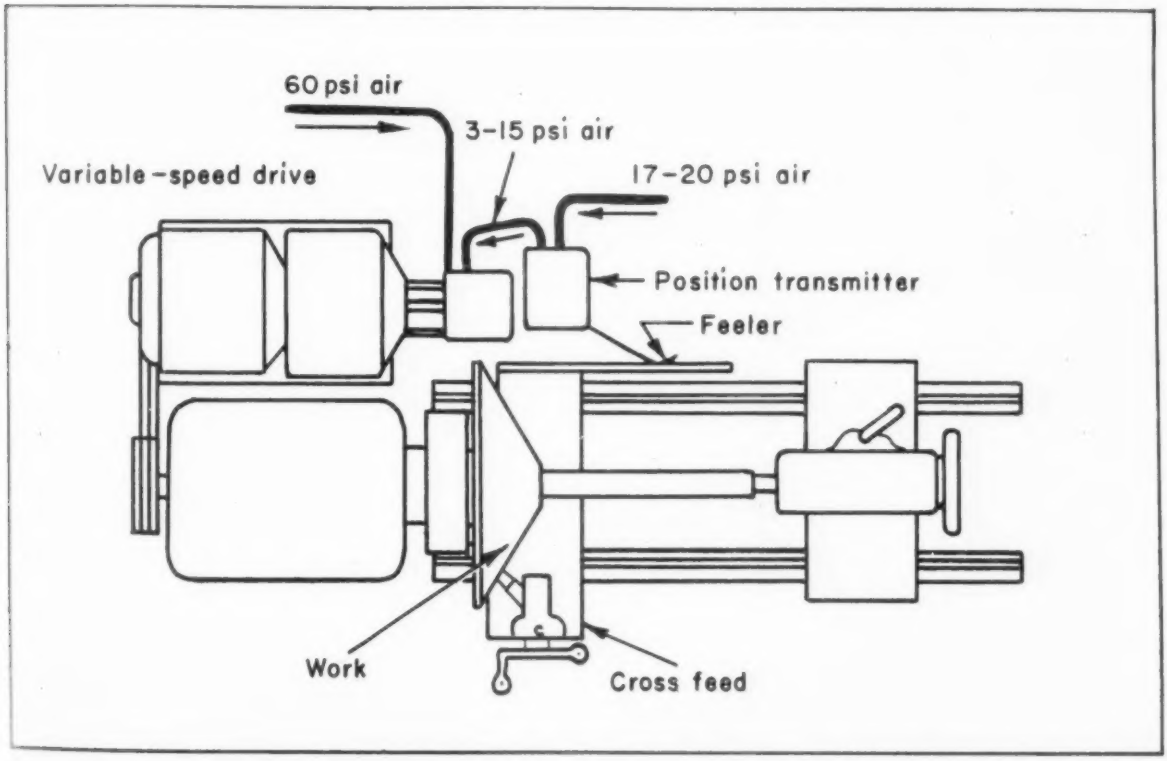
MACHINING the faces of disks, flanges and pulleys has long been a problem in many shops. To achieve a good finish, to have a reasonable tool life and to limit driving power required, cutting speed of the tool must be reasonably constant. When the ratio of the smallest diameter to be cut to the maximum diameter is more than 2:1, it is normally necessary to change the spindle speed. Starting and stopping a lathe to make this change requires valuable time. The alternative of using compromise speeds causes poor finish.

By using the simple drive and control arrangement illustrated, spindle speed can be automatically and continuously adjusted to maintain constant cutting speed. Heart of the system is a variable-speed drive, made by the Reeves Pulley Co., Columbus, Ind. Lathe spindle speed adjustment is made by a pneumatic servomechanism.

The position transmitter feeler continually contacts the cross feed carriage so that every change in position of the carriage causes an equivalent reaction in the transmitter. Each carriage position change modifies the control air pressure in a range between 3 and 15 psi. The control air pressure regulates the air supply to the speed adjustment actuator on the variable drive. Spindle speed is thus regulated to give a constant cutting speed.

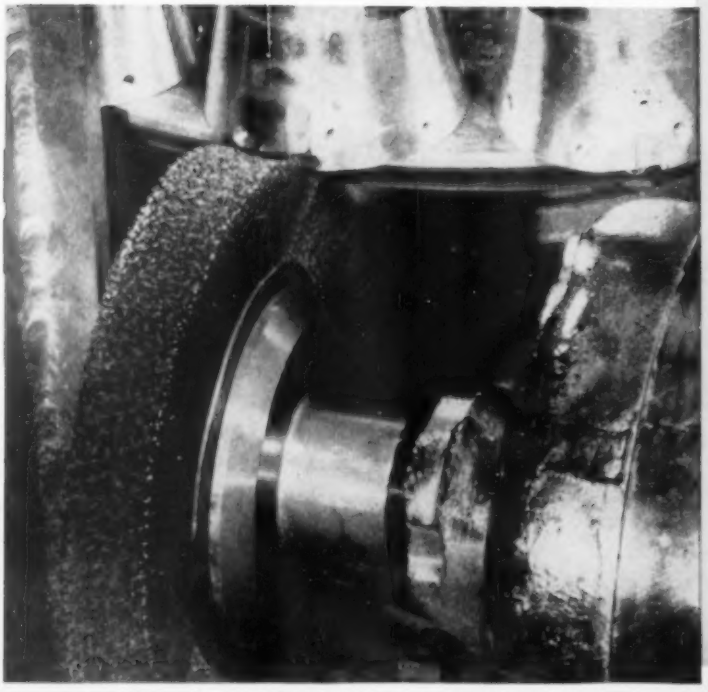
An additional advantage of this system is realized on workpieces with various steps or diameters. No longer does the operator have to make a spindle speed adjustment between steps. Speed is automatically set to diameter, regardless of length or depth of cut. The speed remains constant while a single diameter is turned.

Constant cutting speed is easily achieved on a lathe through use of a continuously-adjustable-speed drive with associated controls.

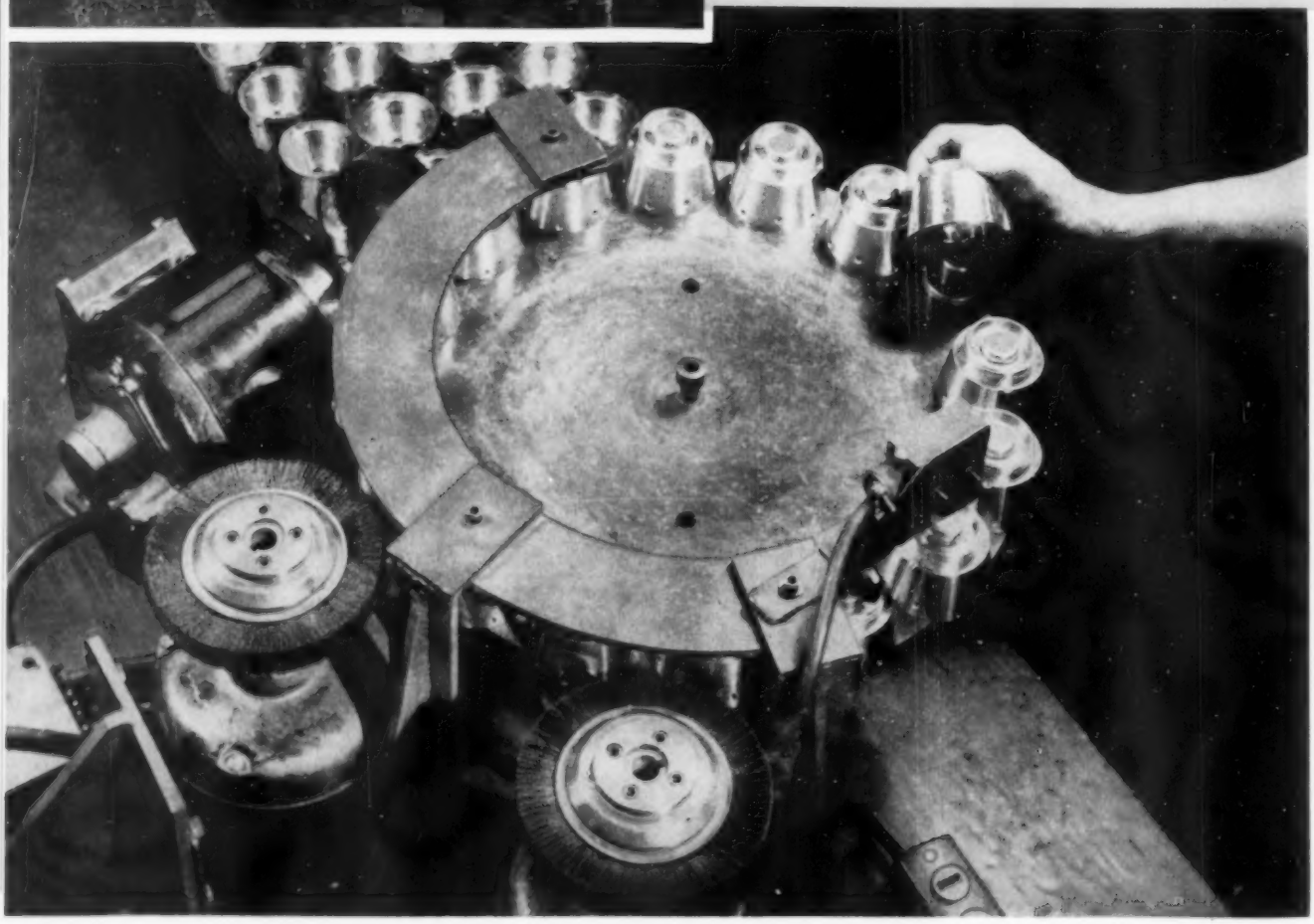


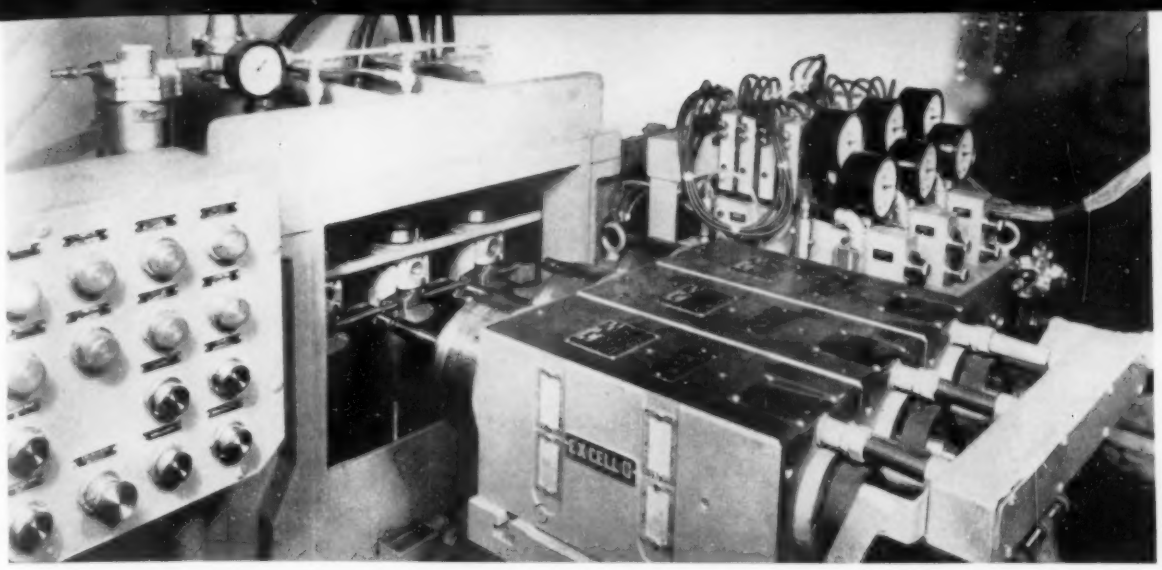
TOOLS at work

—*Photos courtesy Osborn Mfg. Co.*



POWER BRUSHING removes feather burrs from a machined slot in aluminum fuse components in this setup at the rate of 1400 per hour, an increase of 300 percent over the previous hand method. The first brush rotates clockwise against the slot; the second rotates counter-clockwise, brushing the opposite side of the slot. The third brush, shown in the close-up, sweeps down through the slot to finish the bottom. Hand processing was too slow, results lacked uniformity and edges were poorly finished.



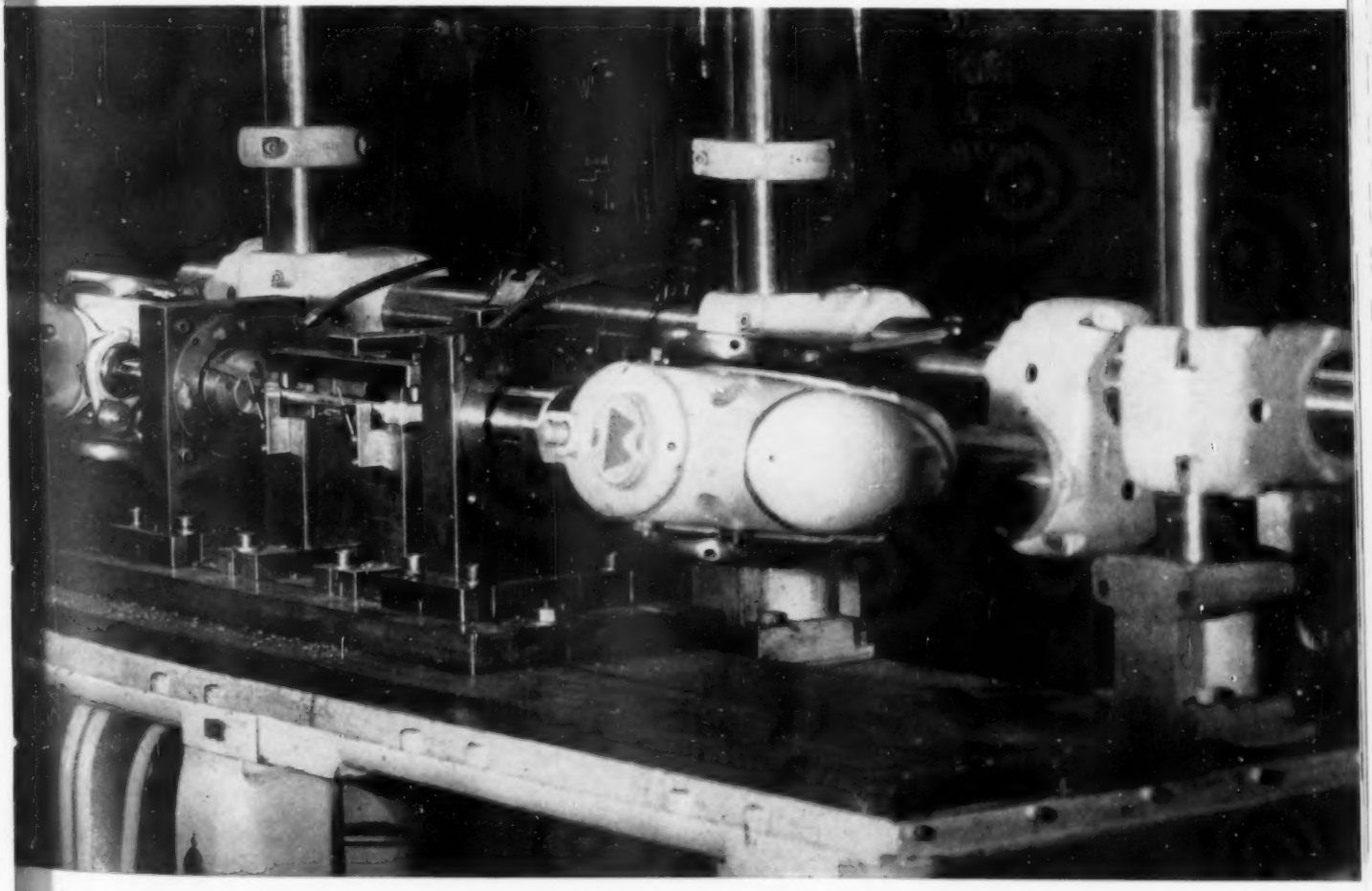


—Photo courtesy Sheffield Corp.

AUTOMATIC GAGING assures production of piston pin holes within tolerance in this boring setup. After holes are bored, an electropneumatic mechanism gages the holes to a tolerance of 0.0004 inch. Red or green signal lights are energized when a dimension approaches within a tenth of either tolerance limit. The machine is stopped if an out-of-tolerance part is produced.

HOLLOW MILLING both ends of a malleable iron weaving knife is accomplished at H. F. Livermore Corp., Boston, Mass., by means of this opposed drillhead machine. Cut is $\frac{1}{8}$ by $1\frac{1}{2}$ inches long; feed is 0.003 inch. Each tool slides through a large support bearing in each end of fixture to eliminate chatter. Changeover for different lengths of parts is made by simply moving the heads on the horizontal columns. Clamping fixture is recentered to complete the adjustment. Quality is improved, production is doubled and machining costs are halved by this setup.

—Photo courtesy Magna Engineering Corp.



charts

used for controlling quality of assemblies

By Martin H. Saltz

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Fig. 1. Inspection of this assembly made of many smaller elements and subassemblies results in a record of defects.

FOR MOST INDUSTRIAL PROCESSES either $\overline{X}$ and R, or p charts are adequate to control quality. There are, however, certain specialized applications where the c chart (control chart for defects) is best suited.

Primarily the c chart is useful for dealing with complex parts or assemblies, *Fig.* 1. In contrast with the $\overline{X}$ and R chart, which is used in controlling a single characteristic or measurement of a part, or the p chart, which is used on large production runs where the process is stable, an operation must be analyzed with respect to theoretical requirements to determine if the process is adaptable to control by the c chart. Where applicable, however, the control chart for defects is a very effective tool.

If assemblies are inspected and defects per assembly counted and grouped according to number of defects per assembly, a histogram results. The length of ordinates for each section of the histogram can be calculated by the Poisson equation:

$$p(r) = \frac{m^r e^{-m}}{r!}$$

where

$p(r)$ = length of ordinate (the probability of getting exactly r defects)

e = Napierian constant

m = average defects per unit in process

r = number of defects in sample

In order to apply this equation to a process, the number of possible defects per unit produced must be relatively large while the chance for a defect occurring at any particular point must be small. If a process meets this qualification, then it is fairly certain that the Poisson equation is applicable and that the process is adaptable to the c chart for control purposes.

For example, in a wired electrical assembly numerous defects are possible. Although the number of these items is large, the probability of any particular point being defective is relatively small. In such a case the c chart can be applied. Similarly, the mechanical parts in assemblies and painted and plated surfaces can be analyzed.

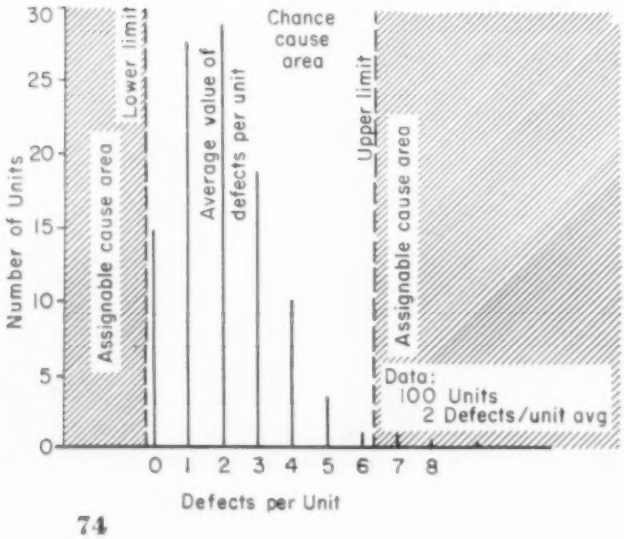


Fig. 2. Ordinates of Poisson Distribution showing limit lines.

If the defects in a unit that is being charted are counted and the number falls within calculated limits, *Fig.* 2, it is fairly certain that the process is in statistical control and is being affected only by chance causes. If the point falls outside the distribution, it is an indication that an assignable cause has developed which is affecting the process.

General practice has established that variations and defects per unit beyond the 3 sigma (σ) limits as shown in *Fig.* 2, will be considered assignable. In fact it can be shown that approximately 99 percent of the time if a value for defects per unit falls outside of these limits it is a true indication of an assignable cause. The average value for defects per unit $\bar{c}$ is the measure of the central tendency.

The 3 σ limits for the c chart are as follows:

$$\text{Upper control limit } (UCL_c) = \bar{c} + 3(\sqrt{\bar{c}})$$

$$\text{Lower control limit } (LCL_c) = \bar{c} - 3(\sqrt{\bar{c}})$$

When considering establishing a control chart for a typical final inspection area where complex electrical and mechanical assemblies are being inspected, a form such as shown in *Fig.* 3 should be devised. Part A of the form serves to identify the unit being charted and the area in which the work is taking place. Part B is used to record the serial number of the assembly and the number of defects found in it. Grid area C is used for plotting defects per unit.

The first step in setting up such a chart is to inspect a unit, count the number of defects found and enter it on the form in the appropriate space. This should be repeated for the next 20 units, which should be adequate for the computation of trial control limits. Based on the 20 units shown on the data sheet, the upper control limit is 16.09. The lower control limit is —0.59 = 0. When the calculation for the lower control limits results in a theoretically possible negative value, the LCL is set at zero, since in practice a negative value for defects per unit is impossible.

The calculated limits should then be shown on the control charts in addition to the $\bar{c}$ value, *Fig.* 3. As assemblies continue to come through the inspection station, the defects found are counted and plotted on the chart. When points fall outside the control limits an investigation for assignable causes should be made.

Usually certain types of defects are of greater significance than others, so that these should be given more weight in the computations. To do this a variation of the c chart, where demerits per unit are considered instead of defects per unit, has been developed. A classification of defects is first established, each category being weighted in accordance with its importance. A typical classification is as follows:

CLASS 0 (Critical Defect): Demerit Weight 500

1. Will certainly result in a hazardous or unsafe condition during handling, installation or end use.

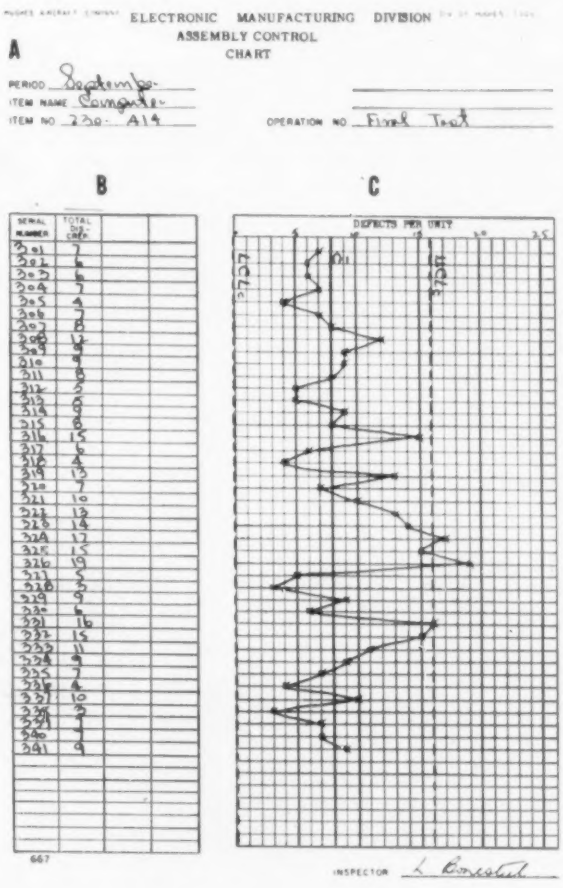
CLASS 1 (Major Defect): Demerit Weight 100

1. Will certainly prevent the apparatus, equipment or system from performing its intended tactical function.
2. Will with reasonable certainty cause intermittent operating trouble difficult to locate in the field.
3. Will certainly fail to meet shelf-life requirements.
4. Will result in excessive maintenance requirements.
5. Will interfere with required installation for end use or adversely affect interchangeability.

CLASS 2 (Minor A Defect): Demerit Weight 50

1. Unlikely to result in functional failure but will result in materially reduced efficiency of operation.
2. Will with reasonable certainty cause intermittent operating trouble which can be readily corrected in the field.

Fig. 3. Form for c chart showing elements: A is identifying information, B is inspection data, C. is finished graph.



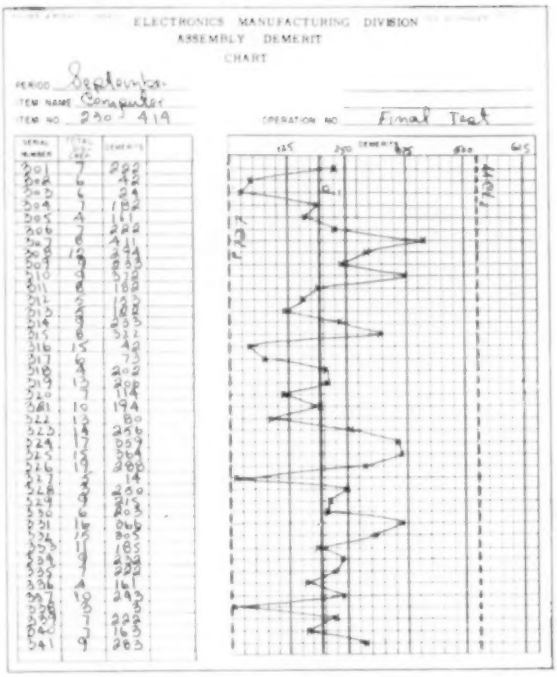


Fig. 4. Form for c chart with inspection data weighted by demerits, according to importance of defects.

3. Will affect only ease of assembly or correct minor adjustment during unit test or other similar tests. (variations from engineering requirements in detail parts or sub-assemblies.)

4. Will surely involve increased maintenance or decreased life.

5. Defect of appearance, finish, or workmanship serious enough to result in the kinds of trouble covered by definitions 1-4 above.

Class 3 (Minor B Defect): Demerit Weight 10

1. Likely to cause trouble of a nature less serious than an operating failure.

2. May cause minor installation difficulties.

3. May cause increased maintenance or decreased life representing a very small change from normal expectancy.

4. Minor defects of appearance, finish or workmanship.

Class 4 (Incidental Defect): Demerit Weight 1

1. Will not affect operation, functional use, maintenance or life of the unit in service.

2. Will not interfere with installation or adversely affect interchangeability.

3. Trivial defects of appearance, finish or workmanship.

With this classification in use the *c* chart becomes one for demerits per unit instead of defects per unit, and the data sheet will now include entries for demerits, *Fig.* 4. The limits on a control chart for demerits are calculated by the following formulas:

σ_d (standard deviation) =

$$\frac{\left[W_1^2 d_1 + W_2^2 d_2 + W_3^2 d_3 + W_4^2 d_4 \ \ldots\right]^{1/2}}{\sqrt{n}}$$

Average demerits per unit =

$$\frac{1}{n}\left[W_1 d_1 + W_2 d_2 + W_3 d_3 \ \ldots\right]$$

where

W = Assigned weight for each classification of defect (W_1, W_2, W_3, W_4 . . .)

d = Number of defects observed for each classification (d1, d2, d3, d4 . . .)

n = Number of units inspected

Since control limits are based on three standard deviations from the average value, the formulas for control limits become:

Upper control limit (UCL_d) =

$$\frac{1}{n}\left[W_1 d_1 + W_2 d_2 + W_3 d_3 + W_4 d_4 \ \ldots\right] + 3\sigma_d$$

Lower control limit (LCL_d) =

$$\frac{1}{n}\left[W_1 d_1 + W_2 d_2 + W_3 d_3 + W_4 d_4 \ \ldots\right] - 3\sigma_d$$

For the data previously secured, *Fig.* 4, these formulas give limits as follows:

$$UCL_d = 190.6 + 338.7 = 529.3$$

$$LCL_d = 190.6 - 338.7 = 0$$

Under this system, defects have been weighted so that more time is spent investigating assignable causes of the more important defects. Such a system also provides data that helps in the allocation of inspection time so that undue expense is not invested in inspecting for defects of no significance. This is especially valuable in receiving departments where inspection is done on vendor furnished parts and assemblies. To compare the quality of products turned out by the day and swing shifts in a plant for instance, requires correction for another factor. The number of units produced during one shift differs from that of the other, which alters the probability of occurrence of a given defect. In order to correct for this, it would be more accurate to maintain the data on a defect per unit per shift basis. In other cases this might be defects per unit per hour, or other interval. In correcting for this, the equations for control limits on the c chart become:

$$UCL_u = u + 3\sqrt{\frac{u}{n_s}}$$

$$LCL_u = u - 3\sqrt{\frac{u}{n_s}}$$

where

n_s = Number of units per time period (shift, hour, etc.)

$$u = \frac{c}{n_s}$$

Similarly, when defects are weighted in accordance

with a demerit system these formulas also have to be corrected and then consequently become:

$$\sigma_u = \left[\frac{W_1^2 d_1 + W_2^2 d_2 + W_3^2 d_3 + W_4^2 d_4 \ldots}{\sqrt{n(n_s)}} \right]_u$$

Average demerits per unit =

$$\frac{1}{n}\left[W_1 d_1 + W_2 d_2 + W_3 d_3 + W_4 d_4 \ldots \right]$$

Upper Control Limit (UCL_d) =

$$\frac{1}{n}\left[W_1 d_1 + W_2 d_2 + W_3 d_3 + W_4 d_4 \ldots \right] + 3\sigma_u$$

Lower Control Limit (LCL_d) =

$$\frac{1}{n}\left[W_1 d_1 + W_2 d_2 + W_3 d_3 + W_4 d_4 \ldots \right] - 3\sigma_u$$

where

n = Number of units inspected

The c chart, based on a Poisson distribution, thus has a valuable application in production quality control. In addition it can be used for other purposes such as, for example: accident data, forms completed by office personnel and lateness. These and similar factors can be analyzed by the application of the techniques outlined.

Improved Clean-up for Castings

IN THE STEEL CASTING INDUSTRY, a necessary time-consuming job is the cleaning operation to correct defects and remove excess metal from large castings. A simple, ingenious method put into effect at the ACCO Casting Div. of American Chain & Cable Co. has reduced the time-eating work by as much as 75 percent which at the same time offers a higher quality finished job.

The operation, known as the Kwik-Arc Jet Torch Process, involves a torch made of a ½ inch diameter carbon electrode, secured in a holder, with a small air jet beneath it. When ignited, the electrode generates an arc electric of 6,000 F which melts shrinks, cracks, fused-in sand, fins brackets, nails and other undesirable matter. The accompanying jet of air blows the molten metal and slag away, leaving a casting of generally uniform contour. The jetted area cools in a few minutes, and is then rebuilt with sound weld metal before the casting reaches the chipping and grinding operation.

Not only does this method speed the cleaning operation, but it has been found to remove less of the parent metal than does the usual chipping gun. Naturally, subsequent welding and grinding are kept to a minimum. Further, the jet torch work does not cover up defects which might show up later.

Prime expense of the method is the cost of erection of metal welding booths to house the operation and protect other workers in the area from the attendant intense light.

Jet torch operator removes excess metal from a large pressure seal valve body. The torch melts surface imperfections which are then blown away.

ISOTOPE INSPECTION controls quality of product

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Fig. 1. Nuclear gage in operation on processing line. The gage is positioned to any desired spot across the web by push button control.

NUCLEAR GAGING has proved itself as an integral part of production control in the manufacture of coated abrasives. The new production technique, employed at Carborundum's coated products division for more than a year, *Fig.* 1 provides a degree of processing control accuracy previously unheard of in the industry.

Production control has, until now, been on a cut-and-try basis. The many product variables to be satisfied, processing speeds of the continuous production line-up to 350 feet per minute, *Fig.* 2, and the very nature of the product which prohibits mechanical contact during or after processing, are obstacles that have hindered the manufacturer in producing coated abrasives to strict specifications.

For example, there are some 2000 basic types of coated abrasives produced, *Fig.* 3. These include abrasives such as flint, emery, silicon carbide, aluminum oxide, garnet, crocus and cork, in particle sizes ranging from six ten-thousandths to one-eighth of an inch. They are coated on paper, cloth, fibre or combinations of these materials and bonded with glue, resin or varnish. Another variable is in the density of the abrasive grain coating.

Before the development of nuclear gages, quality was controlled by stopping the machines after a number of yards of coated material had been run, taking samples, checking each sample and then adjusting rolls and feeds. Close control was costly and exact reproduction of previous runs, difficult.

These problems were overcome with the installation of a series of five nuclear gages on one of the continuous coated abrasive processing lines, *Fig.* 4. In the manufacture of coated abrasives, a layer of adhesive is calendared on one side of a backing material and, while the adhesive is still tacky, abrasive grains are imbedded in a definite pattern. The web is partially dried in a festoon drier to preserve the orientation and another adhesive application is made to anchor the abrasive grains. The product is then dried and cured. A vital factor in the process is the provision for a well-oriented abrasive coating.

Five gages are shown in *Fig.* 3: The first gage measures the weight of the backing and serves as a check on the laboratory; the second measures the backing plus adhesive; the third measures the backing plus adhesive plus abrasive; the fourth measures the same elements as the third except that the material has passed through the festooning rack and has lost most of the solvent in the adhesive; and the fifth measures the aditional weight of the adhesive applied at the sizer.

Each of the five gages can be position at any spot across the width of the web by simply pushing a button. This gives the operator information, previously unavailable, regarding cross-the-web adjustments.

A nuclear gage, *Fig.* 4, uses a beam of high-speed beta rays emitted by radioactive strontium 90 in a

sealed capsule located in the lower jaw of a U-frame, and a radiation detector in the upper jaw. The amount of radiation that penetrates the sheet passing between the jaws and reaches the detector is inversely proportional to the mass of material in the measured area.

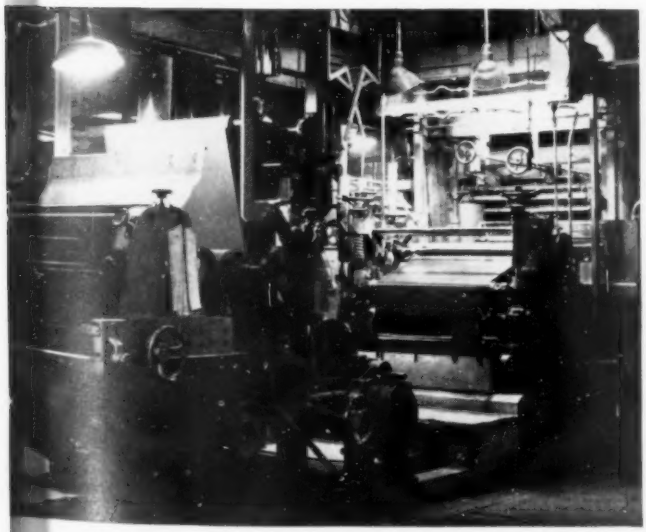
This means that fundamentally the gage measures weight per unit area, the same information that is obtained by weighing a sample of known area in a balance. The beta rays that get through to the detector unit (a special type of ionization chamber) ionize an inert gas and thus create a tiny voltage that eventually provides a recording and controlling signal.

In normal operation, the gage is automatically standardized at one-half hour intervals; hence recalibration is seldom necessary. The radiation source has a half-life of 25 years and presents no serious replacement problem. Signals from the gages are translated into a trace on pen recorders. The trace signals from the first two gages are superimposed on one recorder; likewise the second and third gages record traces on another recorder, etc., *Fig.* 4.

Gage accuracy is within one percent. Gage indications, expressed as small voltages, actuate recording devices, *Fig.* 5, to provide permanent records of each production run and, at the same time, signal for production-line adjustments that can be made in a matter of seconds without stopping the high-speed machinery. Now the gaging arrangement has been improved to provide for automatic adjustments for control of the adhesive rolls and the entire system will eventually be completely automatic.

Fig. 2. (lower left) Coated abrasive making machine. Backing material enters at left. Parts of nuclear gage installation are visible at upper left and center right.

Fig. 3. (lower right) Types of coated abrasives produced include rolls, belts, disks, sheets, molded shapes and cartridge rolls.

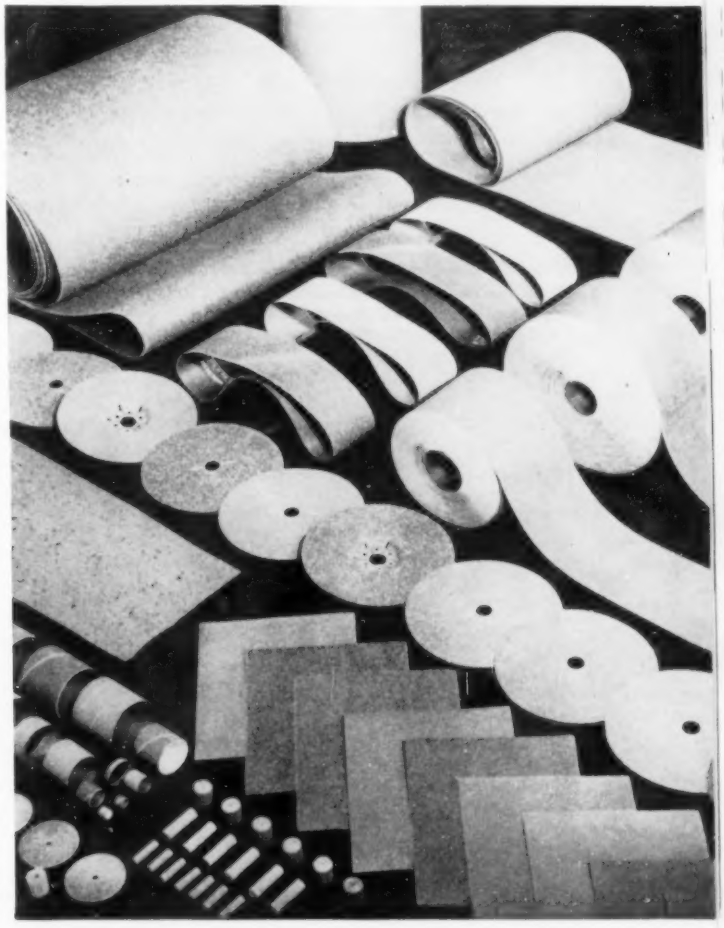


The gages provide 100-percent continuous sampling. They are not influenced by outside factors such as temperature, dirt, humidity, and they make no contact with the moving sheet. When the traces overlap the material is being made according to specification, *Fig.* 6. Any change can be observed immediately as shown in *Figs.* 7, 8 and 9. Corresponding corrections may be made in adhesive feed, abrasive feed, machine speed, or other variables.

Comparative studies have been made first with the gages in use but with the recorders covered and with the operator making his usual adjustments. Then, with the gages uncovered so that the operator could see the traces, adjustments were made accordingly. This was done previous to the installation of the fully automatic control.

An analysis of the traces before and after the tests revealed a number of interesting facts. Gage one, for example, indicated in a split trace, such as in *Fig.* 8, that some weights of backing materials varied considerably more than suspected—as much as twice the allowable weight tolerance in both length and cross-direction.

Gage two, which measures backing material plus adhesive, revealed that adhesive weights varied as much as 10 percent between weight stops without detection by the inspector. With beta-ray gage



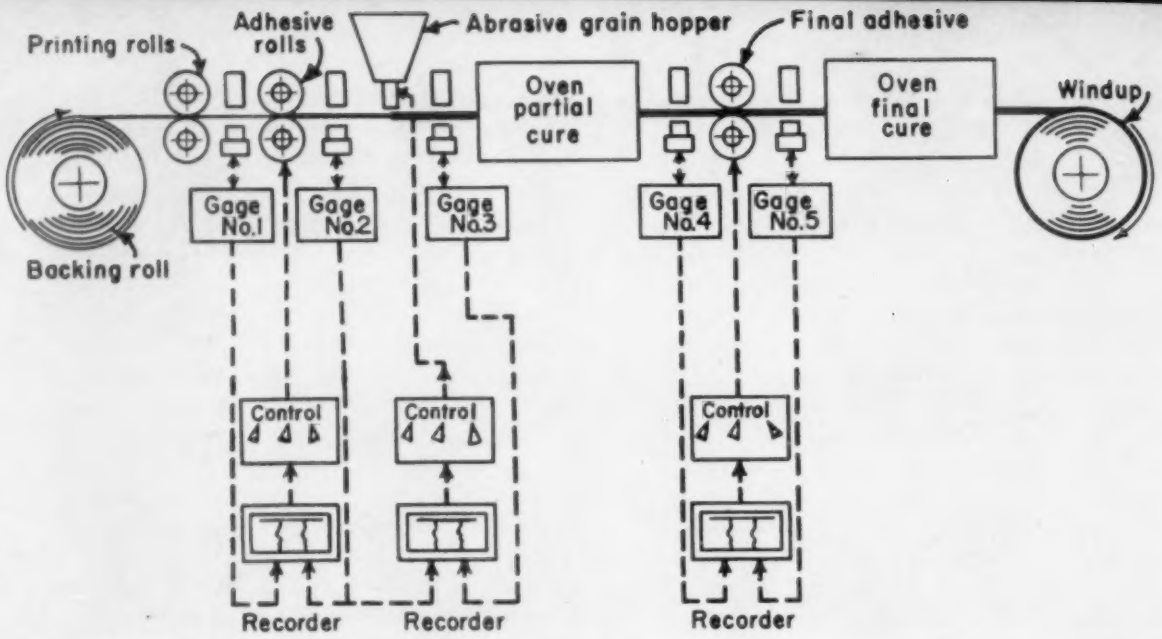


Fig. 4. Schematic arrangement of nuclear gaging installation. First gage weighs backing; second weighs backing plus adhesive; third weighs backing, adhesive and abrasive; fourth weighs product after partial cure; and fifth gage weighs final product. Setup permits automatic, precision control.

control, it was demonstrated that the variation could be held to plus or minus 1 or 2 percent. The signal from gage two was subsequently harnessed to control the adhesive application rolls automatically. This permitted the machine operator to spend more time on other duties and reduced adhesive variations.

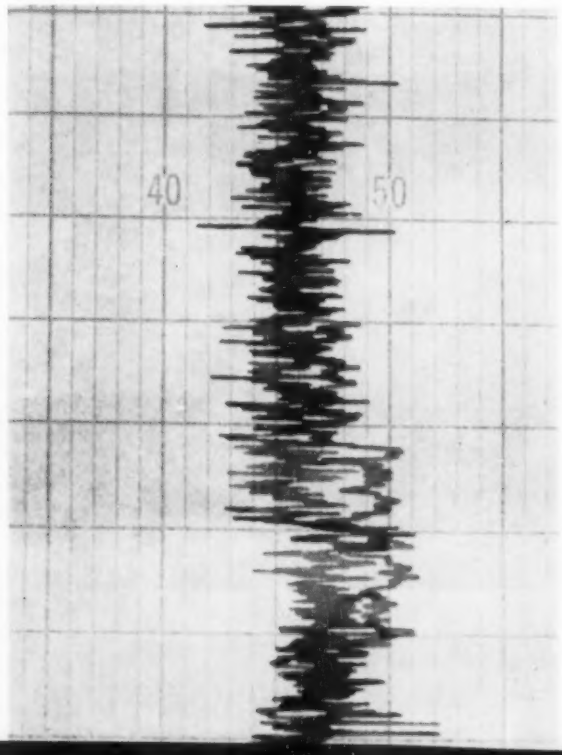
Gage three, which measures backing plus adhesive plus abrasive, showed that with an increase or decrease in adhesive, a similar increase or decrease in abrasive was encountered, thus compounding the deviation from standard, *Fig.* 7.

Gages four and five which measure backing, adhesive, abrasive, and final adhesive coating, showed that regular variations were further exaggerated with the application of the size adhesive. An examination of the traces also confirmed the existence of certain mechanical defects which were otherwise difficult to identify. One of these faults was due to the effect of a splice passing between the adhesive applicator rolls. The roll springs apparently did not return the rolls to their normal setting and caused the adhesive deposit to increase as much as five percent.

The separation of traces from gages two and three, *Fig.* 8, results from a greater than normal

Fig. 5. Recorder gives continuous indication of production conditions. Records can be kept permanently for duplication of orders.

Fig. 6. Nuclear gage recorder pattern when coated abrasive product is being made according to specification.



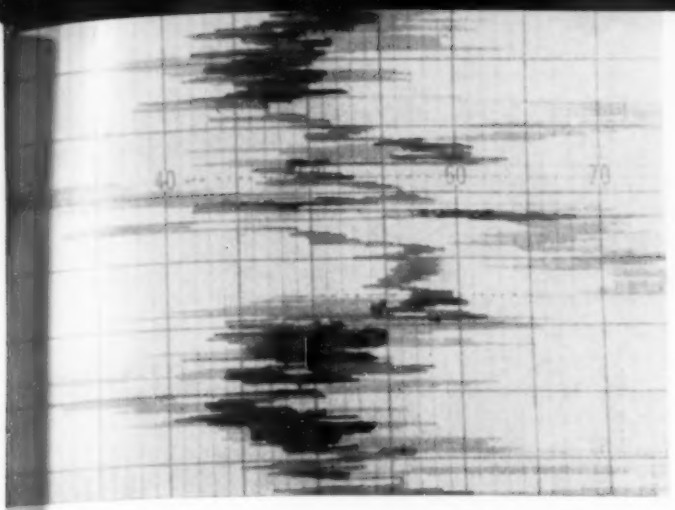


Fig. 7. (above) **Recorder pattern indicates abnormality in production, in this instance variation from standard abrasive weight.**

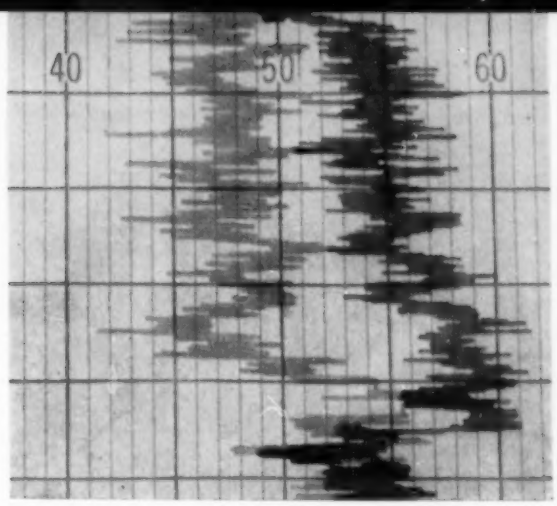


Fig. 8. (upper right) Separation of traces of gages two and three, resulting from greater than normal machine speed variations. Reduction in speed causes decrease in adhesive weight and an increase in abrasive weight.

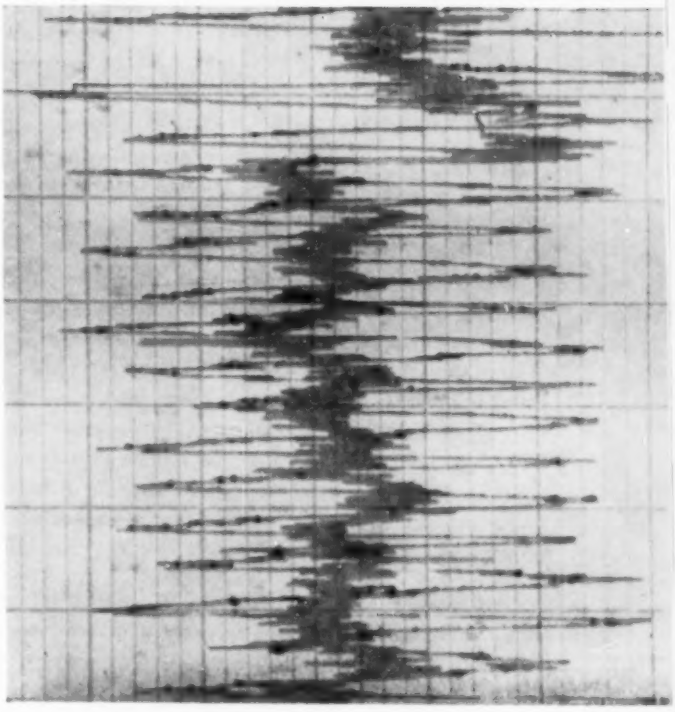


Fig. 9. (lower right) Unusual trace pattern caused by voltage leak in electrostatic belt near a splice.

machine speed variation. An increase in speed causes the adhesive weight to increase and the abrasive weight to decrease. A decrease in speed has tho opposite effect.

A separation of traces, in which the adhesive trace was breaking away from the backing trace, was found to be caused by a decrease in the viscosity of the adhesive. The ability to measure this effect quantitatively led to the installation of an automatic adhesive viscosity control. The significance of the adhesive trace wandering back and forth across the backing trace, similar to pattern shown in *Fig.* 7, is adhesive stoppage. Cleaning the plugged adhesive circulating pump restored normal circulation.

Other mechanical defects disclosed by the nuclear gages are evidenced in *Fig.* 9 by the cyclic variations in the grain traces in the direction of the web. Such traces may be due to such things as a voltage leak in the electrostatic belt near a splice or faulty bearings on one side of the adhesive applicator rolls.

The beta-ray gage setup has been in daily operation for more than a year to date and company engineers estimate total annual savings of approximately $100,000 resulting from their use, as follows:

1. A saving of about $13,000 in material that would have been wasted through stoppage marks and sample cut-outs (the previous methods of process control)
2. An estimated saving of $12,000 due to a reduction in machine down time for sampling and maintenance
3. An increased efficiency in raw material utilization, an estimated saving of $45,000
4. Reduction of inspection personnel costs of about $7500
5. Increased operating speed resulting from the ability to adhere more closely to specifications, estimated at $4000
6. Reduction in rejections of about $15,000.

An intangible advantage, but one which certainly outstrips all others in value, is the improvement in product uniformity and reproducibility obtained. Satisfaction with performance of the gages is evidenced by the fact that another machine has since been equipped with a similar installation.

The consequences of the process control installation in bringing precision accuracy to a heretofore difficult process problem will no doubt reach into many other industries. It is expected that customers will not only benefit from improved quality but techniques will correspondingly improve, making practical greater precision in the control of industrial processes.

High-Speed Photography

stops tap breakage

By William G. Hyzer

Consultant, Janesville, Wis.

BECAUSE they were having trouble with excessive tap breakage on one of their prototype machines, and because its operation could not be visually analyzed, the Gilman Engineering Co. called in a high-speed photography consultant. The machine simultaneously drills and taps eight holes in an aluminum fuse piece, *Fig.* 1. The eight chucks, fitted with axial-floating tap holders, and combination drills and taps, are powered by separate motors that are cam-fed into the piece. Automatic sequence requires three steps: (1) drill at a rotational velocity of 7200 rpm, (2) tap at a rotational velocity of 3600 rpm and (3) withdraw at a counter-rotational velocity of 3600 rpm.

Occurrence of tap breakage was erratic but it could be associated with certain spindles on the machine. There were no apparent reasons for adverse performance of any station on the machine. It was thought that any or all of three possible design weaknesses might account for the high breakage: (1) a prolonged transition period from drilling speed to tapping speed would allow the tap to enter the piece with excessive turning speed, (2) stalling of the motors during the tapping phase would allow the cam-actuated feed to override the axial-floating tap and cause breakage or (3) a completely stalled tap could be fractured during the withdrawal because of the high starting torque of the induction motors used.

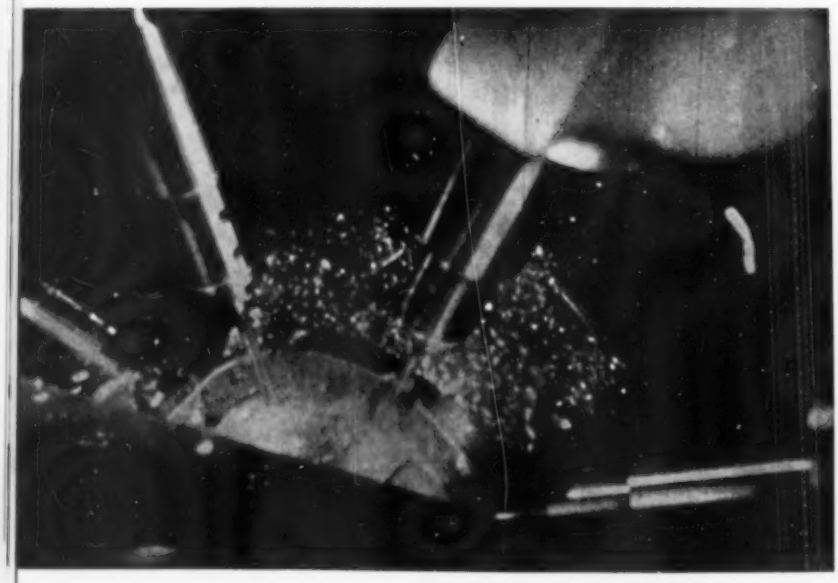
Films were made of the fast-moving action at the rate of 3000 frames per second. No tap breakage occurred during the motion picture sequence but subsequent analysis of the films pointed out malfunction.

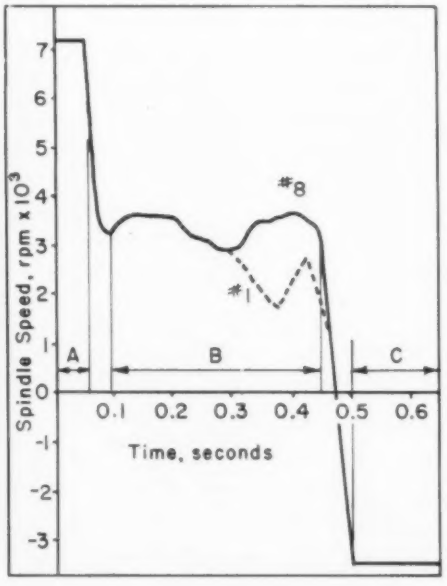
When the films were projected at normal speeds, the machine action was reduced about 200 times. Measurements were made from individual frames, resulting in the graph of two stations shown in *Fig.* 2. Timing marks on the edge of the 16-mm motion picture film made possible precise determination of velocities and accelerations. The drilling operation takes place in interval A, the spindle slows down for tapping which takes place in interval B and the spindle is reversed for extraction of the drill and tap during interval C.

The performance characteristics of the two typical stations are identical until midway in the tapping step. The graph indicates that spindle No. 1 nearly stalls at this point. Tap breakage was associated with this stalling tendency of the drive motors. Further analysis disclosed that a build-up of chips in the hole, resulting in tap seizure.

Fig. 1. (left) Enlarged frame of 16-mm film shows combination drills and taps working on aluminum fuse piece.

Fig. 2. (right) Rotational velocity characteristic graph of two typical spindles shows slowing of spindle No. 1 during tapping.





classification of cutting fluids by use

By R. G. Moyer

Group Engineer
Research and Development Laboratories
The Pure Oil Co.
Crystal Lake, Ill.

SELECTION of the proper cutting fluid for a specific machining operation is still based on past experience. Although considerable effort is being expended toward developing a rapid, inexpensive, laboratory test for determining performance of cutting fluids, a shop test is still the only successful method. As the result of a survey among manufacturers, the Society of Automotive Engineers, Subcommittee on Cutting Fluids, was able to gather much experience data together.

Light severity operations are normally run at high speed, which generates considerable frictional heat. Since water has two times as much capacity for heat as oil, soluble oil emulsions are generally used in such applications. Because surface finish is good, wet or dry, at high speeds, extension of tool life through cooling is the main purpose of a cutting fluid. Tool life on high-speed operations is effectively extended by use of emulsions. As operation severity increases, speed decreases and frictional heat is of less importance. Lubrication becomes important and is supplied by emulsions containing more oil or by straight oils.

Further increase in severity causes pressure between the chip and the tool sufficient to rupture a mineral oil film. Under these conditions, fat or fatty oil that has "polarity" (a strong tendency to adhere to metal) is used either with mineral oil or alone. Further increase in pressure can cause even the film of fat molecules to rupture, so that anti-weld agents, such as chloride and sulphur, must be provided. Fatty oils are not too stable and tend to turn rancid with age, resulting in some substitutions with mineral oils containing small amounts of sulphur, chlorine or both.

The table presented on the next page classifies metals by machinability ratings and lists operations by severity. This table was prepared by a major oil company as a result of the SAE survey. To make it universally usable, a letter code has been substituted for brand names. Individuals can set up their own brand name code to match the letters. When an oil is successfully used in an application that satisfies the conditions of the table, that brand name and specification will apply throughout the table wherever the code letter appears.

This table is not the last word in cutting fluid selection, but once it has been filled in with familiar brand names, it can be useful as a starting point. If production difficulties are encountered, selection of a cutting fluid from the next most severe, or less severe, application will usually eliminate them.

Abstracted from paper 22T1, "Rolled Extrusion of Thin-Walled Parts," presented at the 22nd ASTE Annual Meeting. Copies of the complete paper are available from Society Headquarters.

Cutting Fluid Recommendations by Subclasses of Fluids

Severity	Operation	Machinability Ratings					
		Class 1 Ferrous (>70%)	Class 2 Ferrous (50-65%)	Class 3 Ferrous (40-50%)	Class 4 Ferrous (<40%)	Class 5 Nonferrous (>100%)	Class 6 Nonferrous (<100%)
1 (Most)	Broaching, Internal	A	A	A J	A K	D	C
2	Broaching, External	A	A	A J	A K	D	C
2	Threading, Pipe	A B	A B	A B	A B	D G	D H
3	Threading, Plain	B C	B C	B C	B C	D G	D H
3	Tapping, Plain	A B	A B	A B	A B	H J K	H J K
4	Gear Shaving and Cutting	B	B	B	A	G H	J K
4	Reaming	D	C	B	A	F	G
5	Drilling, Deep	E D	E C	E B	E A	E D	E D
6	Milling, Plain	E C D	E C D	E C D	C B	E H J K	E H J K
6	Milling, Multiple Cutter	E C D	E C D	E C D	C B	E H J K	E H J K
7	Boring, Multiple Head	C	C	C	C	E	E
7	Multiple Spindle—Automatic Screw	C D	C D	C D	C D	F	G
8	High Speed, Light Feed Automatic Screw Machines	C D	C D	C D	C D	F	G
9	Drilling	E D	E C	E B	E A	E D	E D
9	Planing, Shaping Turning; Single Point Tool, Form Tools	E	E	E	E	E	E
10	Sawing: Circular or Hack. Grinding, Surface	E	E	E	E	E	E
10 (Least)	Grinding, Thread	A B	A B	A B	A B		

Key: A—High sulphur mineral-fatty oil
B—Medium sulphur—medium chlorine mineral-fatty oil
C—Low sulphur-medium chlorine mineral-fatty oil
D—Chlorinated mineral oil
E—Soluble Oil Emulsion
F, G, H, J, K—Mineral-fatty oil. (F, highest fatty oil content; K, lowest)

*Metals Handbook, 1948 Edition

news

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Tooling Conference Held on Michigan State Campus

Lansing Chapter Chairman R. F. Geitzel, left, chairman of the Michigan State College conference, greets Swan E. Bergstrom, vice president of Cincinnati Milling Machine Company, featured speaker at the morning session. His topic was "Modern Machine Tools and Increased Productivity."

Luncheon took place in the Ballroom of Kellogg Center. The head table reads: from left, Prof. L. C. Price, head of the MSC Mechanical Engineering Department; Prof. Jay N. Edmondson of Ohio State University; Swan Bergstrom; James Hays, luncheon speaker of the MSC Dairy Department; Harry E. Conrad, executive secretary of ASTE; R. F. Geitzel; Fred Foote, chairman of the Jackson chapter; and Assoc. Prof. R. L. VanDerSlice of MSC.

An afternoon panel on "Gears and Their Fixturization" was presented by Albert Ackerman, Laurence Harrington and Bill Murray. Standing are: Ted Vickers, Glenn Collins and Fred Foote, session chairman.

A two-man panel on "Machining of Jet Engine Alloys" featured John Howe, left, supervisor of production engineering, and Ray Burns, production engineer, both of Oldsmobile Division of General Motors Corp., Lansing.

"Small Die Design and Maintenance" was discussed by Edward Stouten, pictured on left, of Murray Engineering, Saginaw; and George Rice, on the right, sales engineer for Renaud Plastics, Inc., Lansing, presented a talk on "Plastics for Tooling."

James Hays, luncheon speaker, used a model to present his tongue-in-cheek version of how a cow's anatomy ought to be changed.

Members from Lansing, Jackson, Western Michigan, Detroit, Muskegon, Pontiac, Saginaw Valley and Waterloo Area chapters met for lunch during the day.

connecticut day

By A. Douglas Proctor
Hartford Chapter

Henry E. Busby
Fairfield County Chapter

Silas W. Becroft
New Haven Chapter

ASTE chapters in Connecticut held their sixth annual Connecticut Day on May 12, with nearly 500 Hartford, New Haven and Fairfield County members participating. The programs offered tours of five major plants in the Hartford area, a panel discussion on tooling and die applications, and a banquet held at the Hotel Bond.

John Lodge, governor of Connecticut, sent an official statement describing the vital contribution made by tool engineers in maintaining vigorous industrial development. His letter was read to the banquet audience by Alfred D. Bodine, member of the Connecticut Development Commission.

Principal speaker at the banquet was Col. Wilbur R. Carter, deputy director of the Industrial Resources Headquarters, United States Air Force. He discussed the heavy press program being carried out by the Air Force. Other speakers were ASTE President Joseph P. Crosby, who covered the goals of the Society for the coming year; and Mayor D. J. DeLucco, who welcomed the group to Hartford. Toastmaster was Jack Molinar.

Companies visited for tours were: Fenn Manufacturing Co., Royal Typewriter Co., Fuller Brush Co., Pratt & Whitney Division of Niles-Bement-Pond; and Colt's Manufacturing Co.

At the Pratt & Whitney plant tour are: Robert C. King, Charles A. Dionne, I. W. Anderson, George Kendall and an unidentified gentleman at the far right.

Watching a Gray Planer at Fenn Mfg. Co. are: Jesse T. George, Henry Rockwell, (vice president of the firm), Ray H. Morris, Robert Day and Paul E. Dillberg.

The success of this year's Connecticut Day was the result of several meetings and hours of organization by the Connecticut Day Committee pictured here.

Mayor **Hynes of Boston** reads his proclamation to ASTE officials. From left: Charles L. Sadon, first vice chairman; Joseph P. Crosby, national president; Mayor Hynes and Karl G. Nowak, Boston chapter chairman.

Boston Sponsors

Tool Engineers' Day

By Harry Midgley
Boston Chapter

May 13 was officially proclaimed Tool Engineers' Day in Boston by John B. Hynes, mayor of the city. The event was observed by more than 300 persons who attended a program sponsored by the Boston chapter of the Society.

An evening banquet held at the Museum of Science climaxed the ASTE activities. Featured speaker was Charles F. Adams, Jr., president of Raytheon Manufacturing Co., who spoke on "New England Productivity and Tool Engineering."

Guests of honor present at the banquet included: Gov. Christian A. Herter, Mayor Hynes, ASTE President Joseph P. Crosby and Assistant Executive Secretary Allan Ray Putnam.

During the day ASTE members visited three plants in the Boston area. Tours were made at Gillette Safety Razor Co., Ford Motor Co. and the Navy Yard in Charlestown.

A special Tool Engineer's Day feature was published in the *Boston Herald* on Sunday, May 9. Nearly an entire page was devoted to Mayor Hynes' proclamation, history of the chapter, the day's program and greetings from industrial firms located in Boston and the surrounding area.

Charles F. Adams, Jr., standing, was the principal speaker at the Boston Tool Engineers' Day banquet. The president of Ratheon Mfg. Co., he spoke on "New England Productivity and Tool Engineering."

A pre-luncheon discussion at the second annual Conference for Tool Engineers held May 22 includes: Prof. H. A. Bolz, head of the Department of General Engineering; Roger F. Waindle, immediate past president of ASTE; Dean Frank C. Hockema, vice president of Purdue University; and L. L. Thill, chairman of the Calumet Area chapter.

Indiana Members Meet at Purdue University

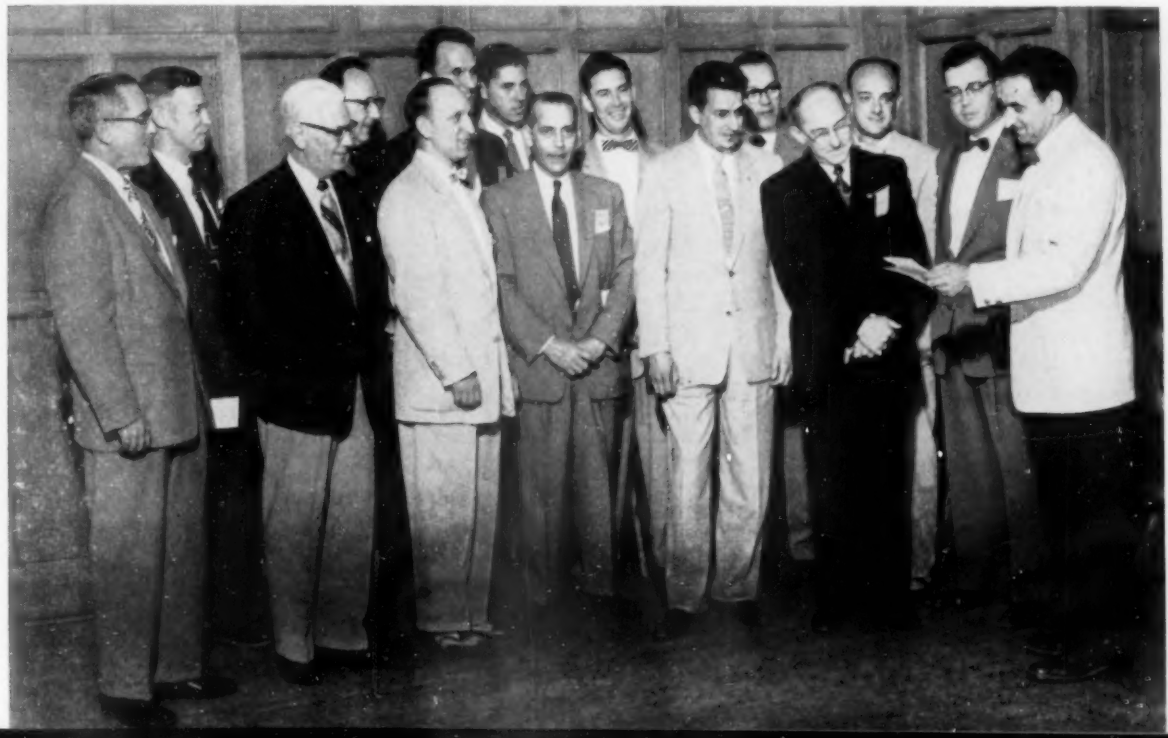
Featured speaker at the evening program held at the Purdue Union was Herbert L. Tigges, sixth from the left at the head table, who is president of the National Machine Tool Builders Association and a past president of ASTE.

Participants in the titanium panel, from left, were: Hans Coster, Purdue University; E. J. Krabacher, Cincinnati Milling Machine Co.; Dr. L. P. Tarasov, Norton Co.; L. W. Colwell, University of Michigan; and Don Welbaum, chairman of the Fort Wayne chapter.

Presenting the discussion on automation were: R. W. Holman, United States Steel Corp.; R. A. Schafer, National Automatic Tool Co.; M. D. Verson, Verson Allsteel Press Co.; H. H. Young, Purdue University; and James Kemp, chairman of South Bend chapter.

This trepanning demonstration, drawing the attention of these members at the Purdue manufacturing laboratories, was also viewed by way of closed circuit television.

Members of the Indiana Council of ASTE, who sponsored the conference in cooperation with Purdue University and the ASTE National Education Committee, hear from Prof. O. D. Lascoe, far right, who was chairman of the event. Shown with them at the far left is Howard C. McMillen, second vice president of the Society.



National Committee Chairmen Appointed

President Joseph P. Crosby has appointed five new national committee chairmen for the coming year.

Prof. Robert McKee, associate professor of production engineering at the University of Michigan, Ann Arbor, succeeds Arthur R. Diamond of Philadelphia as the chairman of the National Education Committee.

Fred J. Kampmeier, vice president of Ingersoll Milling Machine Co. of Rockford, Ill., succeeds H. Dale Long of Chicago as chairman of the National Finance Committee. Mr. Long now serves on the Board of Directors.

T. Bert Carpenter, owner of the Bert Carpenter Machine Co. of Birmingham, Mich., is chairman of the National Honor Awards Committee. Previously the chairman of the National Judicial Committee, William H. Smila headed this group.

W. W. Schug, V & O Press Co. of Hudson, N. Y., succeeds A. B. Clark of Cleveland as chairman of the National Membership Committee. Mr. Clark was elected to the Board of Directors.

Thomas C. Barber, president of Tool Service for Industry of Chicago, succeeds Kenneth W. Riddle of Philadelphia as chairman of the National Program Committee.

The following were reappointed: Edward H. Ruder, vice president of Blackman and Nuetzel Machinery Co., St. Louis, National Public Relations; Francis J. Sehn, vice president of Sahlin Engineering Co. of Birmingham, Mich., National Book Committee; John X. Ryneska, General Electric Co. of West Lynn, Mass., National Constitution and By-Laws; Joseph L. Petz, partner in J. L. Petz Co. of Pleasant Valley, N. Y., National Editorial Committee; William H. Smila, master mechanic at Plymouth Div., Chrysler Corp., Detroit, National Judicial Committee; Prof. L. E. Doyle, associate professor in mechanical engineering at the University of Illinois, Urbana, Ill., National Professional Engineering; and George F. Bryan, supervisor of tool design of GMC Truck and Coach Division, Pontiac, Mich., National Standards Committee.

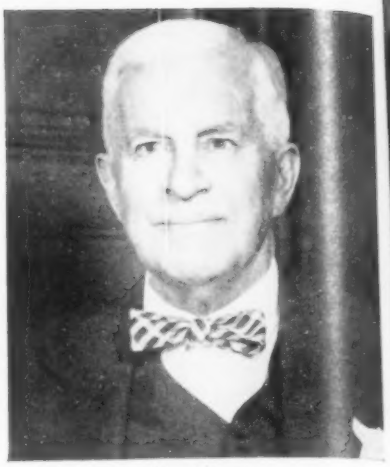
Roger Waindle Addresses Investment Casting Group

With more than a year of organizational planning behind it, the Investment Casting Institute launched its first industry-wide meeting on May 6 at Cleveland's Hotel Carter.

Among the speakers at this first industry-wide meeting was Roger F. Waindle, president of Wai Met Engineering Co. and a past president of ASTE. He spoke on the subject "Specific Problems in Alloy Casting."

The Institute has already begun work on its initial goals of setting standardization of nomenclature, standardization of cast properties (insofar as possible), and the gathering of statistics.

A tour of the ASTE National Headquarters building was on the agenda of a group of consulting engineers from Germany who are visiting the United States to study the role of consulting firms in American industry. Their visit to the country is being sponsored by the Council for International Progress in Management, Inc. Harry E. Conrad, ASTE executive secretary, welcomes Frank Hamilton, project escort and a representative of the council.



Mr. Sharpe

Henry D. Sharpe Dies in 82nd Year

Henry D. Sharpe, noted for many years in the fields of industry, education, finance and social welfare, died on May 17. He was in his 82nd year.

One of the best-known business leaders in New England, he had been the directing head of the Brown & Sharpe Manufacturing Co. for more than half a century.

A forceful and esteemed figure in the ranks of New England business leaders, Henry Dexter Sharpe was interested in a broad scope of dissimilar affairs.

He was president of the Brown & Sharpe Manufacturing Co., one of the largest manufacturers of precision tools in the country for 52 years and served as chairman of the board of directors since 1951; chancellor and a trustee of Brown University; vice president until 1952 of the Providence Journal Co., which he served as a director until his death; trustee of the Rhode Island Hospital Trust Co., and the Rhode Island Hospital National Bank; vice president and a director of the Providence Gas Co.; president of the Puritan Life Insurance Co.; and an officer or a director of numerous other firms.

The unfailing interest of Mr. Sharpe in social betterment through private endeavor was perhaps exemplified best by the creation and successful maintenance of the Providence-Cranston Community Fund. His devotion to strengthening the economy of New England was shown in his leadership of the New England Council, which he twice served as president.

And his lasting desire to see his own city governed well bore fruit in the organization of the Providence Governmental Research Bureau. Later the Rhode Island Public Expenditure Council was formed to undertake similar work in the state and he became its first president.

ASTE Award Winners Announced

Scholarships Totaling $7,000 Go to Ten Outstanding Students

By Edith R. Saunders
Assistant News Editor

Anderson

Cole

Johnson

Kreitner

Le Blanc

Leistikow

Ludema

McBeth

Plenge

Shepard

The 1954 winners of the American Society of Tool Engineers' International Education Awards for engineering students in American and Canadian universities have been announced by Joseph P. Crosby, national Society president. Each of the ten winners will receive $700 for the school year starting in September 1954.

Winners were selected by the members of ASTE's National Education Committee, headed by Robert E. McKee, professor of production engineering, University of Michigan. Other committee members were: Arthur R. Diamond, vice president of Tools, Inc., Philadelphia; Myron L. Begeman, professor of mechanical engineering at the University of Texas; Jay N. Edmondson, professor of industrial engineering, Ohio State University; Orville D. Lascoe, professor of manufacturing processes, Purdue University; Frederick Preator, professor and head of the department of tool engineering, Utah State Agricultural College; and C. Douglas Wright, plant engineer, Houdaille-Hershey Co., Oshawa, Ont.

John Anderson, 20, a junior following the tool engineering curriculum at Utah State Engineering College, ranks second in a class of 54. Active in the college tool engineering club, he was awarded the Sigma Tau Engineering Honor Medal in 1953 and the $100 scholarship offered by the Salt Lake City chapter the same year.

A senior at the University of Texas, John Cole, 21, plans to use his award for a year of graduate study at the Massachusetts Institute of Technology. He has used his summers to good advantage by getting practical experience as a machine and turret lathe operator. Mr. Cole received the Hughes Tool Co. award in 1953 and is a member of ASME student branch, the Engineering Council and Pi Tau Sigma honorary.

A junior at Northeastern University, Carl Johnson, has worked more than a year on a cooperative basis at American Locomotive Co. on design and development of a 16-cylinder V-type engine. Ranking sixth in a class of 290, he is a student member of ASME.

The Canadian award winner, William Kreitner, 22, a junior in mechanical engineering at the University of Toronto, stands second in a class of 50. His practical experience includes work as a power plant fitter, where he designed special tools to repair generators, turbines and auxiliary equipment. He belongs to student chapters of ASME and SAE.

Gilbert LeBlanc, 22, a junior at the University of New Hampshire, is a graduate of the General Electric's four-year apprentice training program. A charter member of the Granite State ASTE chapter, at present he is on leave from GE to get his degree in mechanical engineering. He is also a member of ASME. *Continued on page 94*

Research Fund Member

Joseph Sunnen Receives Horatio Alger Award

Joseph Sunnen, president of Sunnen Products Co., St. Louis, and a member of the ASTE Research Fund Committee, was one of 10 of the nation's civic and business leaders to receive this year's Horatio Alger Awards.

Given in recognition of "public accomplishments and civic achievement as an example to the youth of the nation," the awards were presented in a ceremony at New York City. Winners were presented bronze plaques by the Horatio Alger Awards Committee, a nonprofit organization which provides student aid cash scholarships to youngsters. They were selected by American colleges from a list of 3,000 nominees.

Mr. Sunnen, a manufacturer of automotive machinery and tools, started in business 30 years ago with a garage he established on a small loan. He has been a benefactor of youth, recently giving $200,000 for a lake at a YMCA camp and paying half the cost of rebuilding a church in St. Louis.

Two Men Appointed by Rockford Company

Howard A. Nelson has been appointed to the position of administrative assistant to the sales manager in the Machine and Small Tool Divisions, according to an announcement by Barber-Colman Co. in Rockford, Ill. Also appointed was Stuart J. Johnson who becomes chief engineer of the Small Tool Division. Both men are members of the Rockford ASTE chapter.

Guest speaker F. W. Witzke was introduced by Paul B. Slater at the Los Angeles May meeting. The meeting was held at Scully's restaurant.

Surface Finish Subject of Los Angeles Talk

Los Angeles—Members and guests of the Los Angeles chapter, numbering 150, assembled at Scully's Restaurant on May 13 for their regular monthly meeting.

Featured speaker on the technical program was F. W. Witzke, product supervisor for the Brush Electronics Co. of Cleveland. With the help of slides, he emphasized the importance of "Surface Finish Specifications," and explained the proposed revision of American standards ASA-B-46, which proposes to change surface roughness from a RMS to arithmetic designation.

Wayne Ewing, national secretary of ASTE, and Ben Hazelwinkel, a national director, presented the highlights of the ASTE Exposition.—*J. A. Boettgenbach*

ASTE Headquarters was toured recently by members of the Council of Engineering Society Secretaries. Allan Ray Putnam, far right, assistant executive secretary of ASTE, explains some duplicating equipment to the group. On Mr. Putnam's right are: Council President Ernest Hartford, deputy secretary of ASME; C. S. Doerr, executive secretary of the Engineers Club of Philadelphia; T. J. Ess, managing director, Association of Iron and Steel Engineers; J. E. Harrington, executive secretary, Western Society of Engineers; and K. F. Treschow, secretary of Engineers Society of Western Pennsylvania. About 25 society officials made the tour.

ASTE Education Awards

Continued from page 93

A junior at State University of Iowa, LaVern Leistikow, 27, has summer experience as a laboratory assistant and field testing assistant at Link-Belt Speeder Corp. in Cedar Rapids; and as an assistant at the University metal processing laboratory. Second in a class of 49, he is a member of the student chapters of Pi Tau Sigma, Tau Beta Pi and ASME.

Kenneth Ludema, 26, a senior at the University of Michigan, works for the Department of Industrial Engineering and for the Engineering Research Institute at the University. He plans to continue graduate work toward a master's degree in production engineering. He is a member of student chapters ASTE and the American Foundrymen's Society.

A senior at Ohio State University, James McBeth, 22, has gained practical experience by working in the mechanics department at the university. He is chairman of the ASME student chapter and holds membership in SAE; Ohio Society of Professional Engineers; Society of American Military Engineers; Theta Tau, professional engineering fraternity; Engineers Council; Phi Eta Sigma, freshman scholastic honorary; Pi Tau Sigma, mechanical engineering honorary; and is on the publication staff of the Ohio State Engineer.

A Purdue University junior, John Plenge, 26, stands in the upper quarter of his class. Receiving valuable experience as an apprentice to the plant engineer at Chrysler's transmission plant in Indianapolis, he is the author of an outstanding paper on materials handling which won him the David Wunsch Memorial Award. He is a student ASME member.

Richard Shepard, a 20-year-old mechanical engineering junior at Washington University, ranks second in a class of 30. He has wide experience through his summer jobs as production control clerk and tool designer at McDonnell Aircraft Corp. in St. Louis. He is a member of ASME's student chapter and Pi Tau Sigma, engineering honorary.

Named Manager of Detroit Sales Office

John E. Schobinger, formerly manager of the Hartford sales office for Landis Tool, has been named manager of the Detroit sales office for the machinery division of Gardner Machinery Co., Beloit, Wis., according to a recent announcement. He is a member of the Hartford ASTE chapter.

Appearing on the Wichita program for April on the fundamentals of optical tooling were: Ken D. Paddock of Keufel and Esser Engineering Co.; R. D. Adams of Hollidays, Inc.; Ivan W. Sheridan of Hollidays, Inc.; and Paul C. Bossmeyer of Keufel and Esser.

Donald Farr Talks at Wichita Meeting

Wichita—Donald E. Farr, vice president of the Methods Engineering Council of Pittsburgh, Pa., was the speaker at the May 12 Executives' Night meeting of the Wichita chapter. His subject was "Selling Your Tool Design." The 90 who turned out for the event at Shirkemere Hotel heard Mr. Farr place the tool engineer in the role of a salesman, whose product is a design. He outlined the steps of preparation needed to sell his idea.

On April 14, approximately 175 were on hand for the meeting at the Shirkemere Hotel to hear Paul C. Bossmeyer, sales representative of Kueffel & Esser Engineering Co. The talk, a panel discussion was on "Optical Tooling" with Harold J. Bales, Charles Kellow, and Francis Kile, all of Boeing.

A presentation of the fundamentals of optical tooling was made by A. N. Brunson, past chairman of the chapter; Gene Brunson, past chairman of the student affiliate chapter; and W. L. Egg, representative of Brunson Engineering. —*John G. Temple*

Positions Wanted

WORKS MANAGER—seeks an executive position with a machine shop. Will relocate. Have been with the same company over 30 years, serving in the routing and planning departments. Started out as a journeyman and have experience in tool and jig department as a draftsman. Was in charge of the manufacture of jigs and tools and promoted to superintendent of a plant which employed 400. Have had wide experience in all branches of machine shop, including time and study and rate setting. Additional experience in a cast iron foundry and as head of production department. I am 70 years old, but can lend my experience and be a real help to someone who needs an assistant. Write to Box 411, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

MANUFACTURER'S REPRESENTATIVE—seeking either direct manufacturer's representation in the capacity of direct over-all territory salesman or as a manufacturer's agent for the entire state of New Jersey. Many years of buying experience covering multiple items such as perishable tools, repair parts and tool room supplies. Write to Box 412, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Michigan.

Lansing Speaker Reviews Screw Thread Standards

Lansing—Russell Holmes of the A. C. Spark Plug Division of General Motors Corp. was the program speaker at Lansing chapter's April meeting. He discussed the development of screw thread standards, covering the United Nations committee conferences and military standards for screw threads.

Nearly 50 members attended the session held at the Porter Hotel. Plans for the Michigan State College tool engineering conference were also reviewed at the meeting. —*Harry S. Keehne*

IBM Appoints Engineer

Rudolph Lorenz, Jr., has been appointed to the position of associate engineer in its Plastics Laboratory, according to a recent announcement by International Business Machines Corp., Endicott, N. J. Mr. Lorenz holds a degree from Pratt Institute and is a member of Binghamton ASTE chapter.

Cutting Tool Company Formed by Two Members

A new company at North Tonawanda, N. Y., has been formed by two members of ASTE. Known as the Niagara Cutter Co., the firm was established by Roger W. Bollier and Marshall H. Damerell. Mr. Damerell was formerly associated with Barber Colman Co. as a cutting tool design engineer and Mr. Bollier was chief tool engineer with Union Twist Drill Co. Both are former students of Prof. O. W. Boston, head of the production engineering department at the University of Michigan.

Buhr Machine Tool Co. Announces Promotions

Edward A. Farwig and Otto Haisch have been named to new positions in the Buhr Machine Tool Co., Ann Arbor, Mich., according to an announcement by Joseph H. Buhr, company president. Mr. Farwig, a member of the Detroit ASTE chapter, was stepped up from assistant to the sales manager to chief engineer. Mr. Haisch, a member of the Waterloo Area chapter, took over as assistant to the sales manager.

A joint meeting of ASTE and ASM was arranged by A. R. Fairchild, extreme left, who is vice chairman of the Piedmont chapter and chairman of the AMS chapter. Pictured are: Mr. Fairchild; C. P. Walter of Western Electric Co., coffee speaker; Charles Brown, speaker, from Eutectic Welding Alloys Co.; and S. B. Jeffreys, Piedmont ASTE chairman.

Photographed at the Muncie chapter speakers' table on May 4, from left: Carl A. Darger, chapter chairman; Harold L. Murch, sales manager, Jones & Lamson Machine Co.; Ed Cram, Muncie representative for Jones & Lamson; and Lester Lotz, acting program chairman. Mr. Murch was the technical speaker and addressed his ASTE audience on "Modern Methods of Inspection by Optical Projection," using slides to illustrate his discussion. The dinner meeting was held at the Delaware Hotel.—*Don C. Wedlick*

Pictured here with contest judges are winners of recent industrial drawing and vocational arts awards in the Long Beach area who were guests at the May 12 meeting of the Long Beach ASTE chapter. Speaker at the meeting was F. W. Witzke, product supervisor at Brush Electronics Co., Cleveland, Ohio, who spoke on the advantages of proper surface finish specification with the use of electronic finish indicator. From left to right: John D. Sprinkle, instructor at Long Beach City College; Harold E. Jennings, first place winner in the college division; Earl C. Bobbitt, college third place winner; Kendall Philphy, college second place winner; Bill Talbot, first place winner in high school division; Dwight D. Jenkins, Lions Club judge; Leo Gable, coordinator of vocational and apprenticeship training at Long Beach City College; and Kenneth M. Nelson, ASTE chapter judge.—*C. W. Ward*

Officers of the San Fernando chapter got together for a 'family' photograph at the April meeting of the group. Pictured, from left, are: H. T. Young, chapter chairman; Keith H. Griffin, first vice chairman; Al T. Rando, second vice chairman; Sam Schwartz, secretary; and C. L. Goodspeed, treasurer. At this same meeting, two national ASTE committeemen spoke briefly. They were Ralph Chrissie of the National Program Committee and Al Beaumont of the National Membership Committee.—*Gary Diamond*

Cutting Fluids Topic at Chapter Meeting

Gardner, Mass.—The May 18 meeting of the Northern Massachusetts chapter was held at the Colonial Hotel in Gardner, Mass. Approximately 85 members and guests were on hand to hear Dale Fleming, assistant to L. H. Studholz, research associate at Socony-Vacuum Laboratories, Brooklyn, N. Y. His talk was entitled "Effect of Cutting Fluids on Machining Efficiency." By means of charts and slides he gave a graphic presentation of the comparative merits of various types of cutting fluids now in use.

The chapter has announced that it will award two $250 scholarships to deserving high school students in the area who intend to follow a course in mechanical or tool engineering.

On May 5 the chapter sponsored a tour through several of the local factories for three classes of Athol high school students. It was such a success that the chapter plans to make it an annual event. The students visited Union Twist Drill Co., L. S. Starrett Co., and McElwain Shoe Co.

—*Otto S. Nau*

Chicago Speaker Reviews Uses of Silicons

Chicago—Speaking to 150 Chicago members at the Keymen's Club, Karl Sigmund of the Dow Corning Corp. discussed the uses of silicons in industry at the May 3 ASTE meeting.

The chapter's April session featured a program on optical projection gaging presented by two speakers. They were Edward C. Polidor, vice president of Optical Gaging Products, Inc., and Frank D. Clark, secretary of the Van Keuren Co.

Mr. Polidor's subject matter included the application of tracing and target mechanism, third dimensional optical gaging, and gear analysis and distinction of gear errors by optical gaging. Mr. Clark discussed optical flats and the problems of measuring parts in millionths of an inch. —*R. C. Berliner*

John Delaney Named to Vice President

John Delaney, formerly development engineer, has been named vice president and factory manager of Lincoln Park Industries, Inc., Lincoln Park, Mich., according to an announcement by Gene DeMambro, president. On the Lincoln Park Industries staff since in 1952, he is also a member of the Detroit ASTE chapter.

Discussion on Plastics Heard by Twin States

Claremont, N. H.—Two representatives of the E. I. du Pont de Nemours Company, Inc., polytechemical department addressed the Twin States chapter at the April 14 meeting. The speakers were Richard E. Leary, sales technologist, and Lawrence D. Berkinshaw, sales representative.

They spoke about the countless uses for plastics being developed and the physical characteristics of these materials, such as lightness, tensile strength, moisture resistance, low coefficient of friction, ability to color, toughness, impact strength and abrasion resistance.

The meeting, held at the Hotel Moody, was attended by 65 members and guests. —*Maurice E. Blais*

Ford Motor Co. Manager Speaks on Automation

Buffalo—On May 13 the Buffalo-Niagara Frontier chapter attended the year's outstanding program. Herbert A. Franke, manager of the automation department of Ford Motor Company's Buffalo Stamping Plant, spoke on the subject "Advanced Automation in a Stamping Plant." A film on production pioneering illustrated the talk.

During his discussion, Mr. Franke said, "We believe that automation will create more, not fewer, jobs in our industries. Right now, even though we have automation on a large scale, the Ford Motor Co. has by far the highest employment in its history. Automation is replacing dangerous jobs with safer, easier jobs, and jobs which will hold more interest for the employee."

—*C. S. Oliver*

Mid-Hudson Breaks Attendance Records

Mid-Hudson members broke all chapter attendance records at their May meeting when 184 members and guests attended a plant tour and technical session at Electrol, Inc., in Kingston, N. Y. After the visitation at the firm which manufactures hydraulic landing gears and other hydraulic equipment, the chapter met at a Kingston restaurant for dinner and a technical program.

Speakers were John F. Ceccarelli, manager of engineering and development, and John Frain, project engineer at Electrol. Mr. Ceccarelli explained the designing, testing and manufacturing of aircraft landing gears, and Mr. Frain spoke on other equipment manufactured by Electrol. —*Davis Gale*

George Barrow and Daniel Wesson

Speaker Discusses Investment Castings

Springfield, Mass.—Eighty ASTE members turned out for the April 12 program held at the Springfield Turnverein. The speaker was George R. Barrow, field metallurgist for Haynes Stellite Co., New York City. His discussion of precision investment castings was introduced by Daniel B. Wesson.

A movie entitled "Turning Point" was shown by Monarch Lathe Co.

—*George H. Foy, Jr.*

Steel Mill Toured by San Gabriel Chapter

Fontana, Calif.—Approximately 200 members and guests of the San Fernando Valley chapter participated in a plant tour at Kaiser Steel Mill in Fontana, Calif., on May 12 and 13.

Highlights of the tour included the blast furnaces, coke ovens, open hearth furnaces, soaking pits, blooming, strip and pipe mills.

On May 6, the regular monthly meeting was held in Azusa, and 85 were on hand to hear Ashley Hollingsworth speak on "New Concept of Industrial Drilling," and F. W. Witzke talk on "Surface Finishing." Mr. Hollingsworth is associated with the Magna Engineering Co. in Menlo Park, Calif. Mr. Witzke is affiliated with Brush Electronics in Cleveland. —*Joe Wajdik*

Latrobe Engineer Talks on Tool and Die Steels

Latham, N. Y.—Hendrick Hudson, one of ASTE's youngest chapters, met at the Circle Inn on May 19. Approximately 120 members and guests heard Birger L. Johnson, chief research engineer at Latrobe Steel Co., Latrobe, Pa. His talk was entitled "New Developments in Tool and Die Steels."

On April 21, H. L. Murch of Jones and Lamson Machine Co., Springfield, Vt., addressed the chapter at its regular monthly meeting. Some 50 were present. Mr. Murch's topic was "Modern Methods of Inspection by Optical Projection."

Lisle Morse, Chapter Chairman

Committee chairman appointments are as follows: program—Malcolm MacKenzie; membership—Albert Jacobson; editorial and public relations—James Kiernan; dinner and entertainment—George Westfall; education—Charles Hine; standards—William Edmiston; constitution and by-laws—Frank Miller; and finance—David Done.

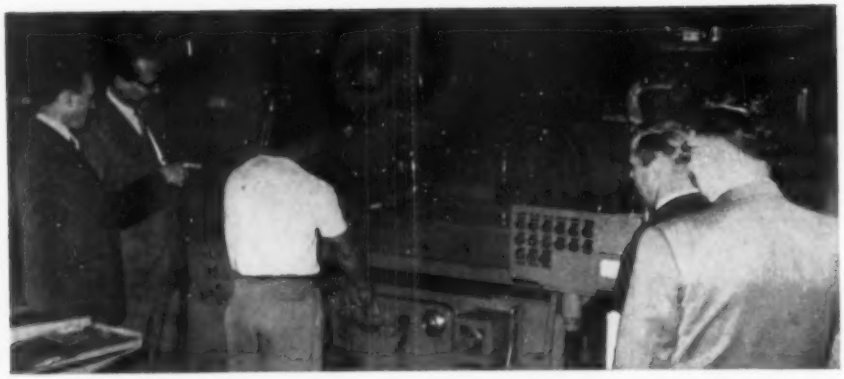
—*James Kiernan*

James Welch Presents Albuquerque Program

Albuquerque—The May meeting of the Albuquerque chapter, held at Leonard's Restaurant, featured a talk by James T. Welch, Cavitron Div., Sheffield Corp., Dayton, Ohio. Mr. Welch discussed the history and development of the Cavitron untrasonic machine tool, explaining the component parts, its uses and limitations.

—*H. E. Anderson*

San Gabriel Valley members toured the Electric Iron Division of General Electric on April 16. 'Automation' was the keynote of the plant visitation.



During a tour of the Thompson Grinder Co. by the Springfield, Ohio, chapter, Ralph Baldenhofer, vice president and works manager of the company, points out some features of the Thompson Crush Form Grinder. The visitation was preceded by dinner at the Rustic Inn and a talk by J. C. Wilson, vice president and sales manager of Thompson Grinder.—*R. L. Horstman*

Studebaker President Addresses ASTE Chapter

South Bend—Harold S. Vance, president of the Studebaker Corp., was the featured speaker at the past chairmen's night meeting of the South Bend chapter held on April 20. Discussing the topic "Maintaining National Security," Mr. Vance compared "capacity to produce and stock piling of war material" as deterrents against war. He said that capacity to produce was by far the cheaper, more efficient and best deterrent against war over a long period of time.

Also part of the evening's program was the presentation of the past chairman's pin to James S. Kemp. The guest prize went to Auggie Swanson.

—*C. David Herring*

Broaches and Broaching Discussed at Canton

Canton—The Swiss Club was the scene of the April 22 meeting of the Canton chapter. Some 63 members and guests were on hand to hear J. W. Dopp, service engineer at Lapointe Machine Tool Co., Hudson, Mass., talk on "Broaches and Broaching." Mr. Dopp presented a brief history on broaching and showed three films on the subject.

Two more student memberships were presented by the chapter. The recipients were: James A. Hummel of the Hoover Co. Vocational School, and Oliver D. Bolton of McKinley High School. Along the line of awards, James L. Nickas, former program chairman and now chapter secretary, received the service award pin for outstanding work in the chapter during the past year.

—*G. C. Hornbeck*

Attendance 250 at Peoria Chapter Meeting

Peoria—A crowd of 250 attended the regular monthly Peoria chapter meeting at the Mecca Supper Club on May 4. The speaker was William Blackie, vice president of Caterpillar Tractor Co., Peoria. His topic was "Time, Space and Work."

The technical chairman for the evening was Gordon Swardenski, assistant manager of manufacturing at Caterpillar.

While attending the family night meeting of the Peoria chapter, held April 7, ASTE members and their guests heard a discussion on bureaucracy by Harry J. Fuller, professor of botany at the University of Illinois. The dinner session was held at the Hotel Pere Marquette. Past Chairman William H. Logue was toastmaster.

Prof. Fuller explained the history of bureaucracy, described its five outstanding characteristics and told how it operates in other fields besides government.

—*Harold D. Baker*

W. D. Davis Heard at New Orleans Meeting

New Orleans—W. D. Davis, district manager for the Fafnir Bearing Co., Memphis, Tenn., addressed the April meeting of the New Orleans chapter. He showed a motion picture on the Fafnir plant and the manufacture of ball bearings.

Among the guests present were H. C. King, J. W. O'Connell, Prof. H. L. Dulad of Tulane, and Prof. W. Schultz of Delgado Trade School.—*Joseph Natal*

Fox River Valley service pin went to Fred Porter, center, chairman of the membership committee. Past Chairman Phil Shaner made the award. Secretary Charles Porter is seated. Technical speaker was J. R. Reinertson of Pivot Punch and Die Corp.—*W. C. Perkins*

Philadelphia Chapter Hears Melvin D. Verson

Philadelphia—Melvin D. Verson of the Verson Allsteel Press Co. addressed the May meeting of the Philadelphia chapter. His subject was "Industrial Press Applications and Tooling."

Mr. Verson's talk was illustrated by two films, one on the manufacturing of Maytag washing machines, the other on a twelve-stage progressive setup for the manufacturing of ice cube trays.

—*Edgar Harrop, Jr.*

Recently-elected Canton chapter officers are sworn in at the March 25 meeting. Andrew B. Clark of Cleveland, far right, member of the National Board of Directors, officiates at the ceremonies. Officers are: from left, Joe Babo, treasurer; James Nickas, secretary; Lloyd Dickerhoff, second vice chairman; John Huet, first vice chairman; and Virgil Shelton, chairman. Speaker at the meeting was W. E. Foreman, field engineer for Norton Co., Worcester, Mass. He discussed "Tool and Production Grinding."

Twin Cities chapter toured Baker-Lull plant during April and Dr. Harry B. Osborn, Jr., first vice president of ASTE was their guest for the visitation. Dr. Osborn, third from right, thanks Chairman Jerome Schwartz for inviting him to go along. From left, are: Louis M. Walton, secretary; Philmore W. Armstrong, second vice chairman; Chairman Schwartz; Robert M. Johnson, first vice chairman; Dr. Osborn; C. Eric Fasth, past chairman; and Arnold Lidfors, treasurer. The group had a complete tour of the plant.

Positions Available

MECHANICAL DESIGN ENGINEERS, TOOL ENGINEERS, AND SENIOR DRAFTSMAN—Permanent positions in Southern California's finest residential community with a well-established company—both civilian and ordnance products. Five years experience in board work, design of special and high production machinery necessary. Small precision parts production. Basic knowledge of gages, jigs, fixtures, tooling, dies and material handling. Must be willing to do board work. Excellent pay and working conditions—free medical surgical, hospitalization and life insurance—paid vacations and holidays. Forward complete resume to Personnel Department, Hunter Douglas Corporation, 3016 Kansas Ave., Riverside, California.

J. R. Stoddard Speaks to Richmond Chapter

Richmond, Ind.—Members and guests of the Richmond chapter met at LeLand Hotel on May 11 to hear J. R. Stoddard of Barkley & Dexter, Boston, Mass. More than 60 were in the audience when Mr. Stoddard talked on "Mechanical Developments of Automation." Several films were shown including one on "Handling Scotch Tape Dispensers."

ASTE members in Richmond, Ind., traveled to Connersville on April 13 for a plant tour of Roots-Connersville Blower Co. Nearly 100 participated in the visitation. E. D. Roudebush, vice president in charge of manufacturing, spoke to the group. His firm makes blowers, meters, pumps and purgers for use in handling air and gas.

A feature of the program was the presentation of the past chairman's pin to Russell Culbertson.

—F. G. Witmer

Worcester Committee Sponsors Classes

Worcester—Through the combined efforts of Worcester's education committee and the administrators of Worcester Junior College, a course leading to an associate degree in tool engineering is now offered at the school.

Work on the program started in the fall of 1952 under the guidance of Franklin Angevine, newly elected chairman of the Worcester education committee, and E. Roland Ljungquist, chapter chairman.

The first course, offered in February of 1953, was on "Jigs and Fixtures," with Michael Kudravetz of the college and Mr. Ljungquist acting as coordinators.

The program was expanded to include a course in "Elements of Tool Design" after the proven popularity of the first course, and plans are under way to add "Measuring and Gaging" next fall. The main problem with all of the courses is seating everyone.

Twin Cities Meets with ASM Chapter

Minneapolis—At a joint meeting of ASM and the Twin Cities chapter of ASTE two technical discussions, one on tool steels and the other on professional registration, were heard by more than 125 persons. The session was held on May 5 at the Coverd Wagon.

Speakers were Dr. George Roberts, vice president in charge of technology at Vanadium-Alloys Steel Co., and Burton J. Robertson, a consulting engineer at Minneapolis-Honeywell.

Dr. Roberts spoke on tool steels, pointing out the effect of varying draw temperatures on the yield point, hardness and toughness of tool steels. Mr. Robertson's address was based on the professional engineers' examination, drawing on his experience as a member of the state examining board a few years ago.

—Walter J. Comstock

Discuss Flame Plating at Lehigh Meeting

Allentown, Pa.—"Flame Plating" was the topic of a talk given at the Lehigh Valley chapter meeting on May 21 at the Hotel Traylor. The speaker was Ray O. Wyland, engineer in the Flame Plating Div. of Linde Air Products Co., New York City. Fifty were present.

On April 23, J. P. Guyer, Jr., regional supervisor of the industrial products department, S. C. Johnson & Son, Inc., spoke to the group on "Metalworking with Wax." The meeting was also held at Hotel Traylor and 55 were present.

Mr. Guyer outlined seven years of intensive research and development in which 1700 varieties of wax were subjected to gruelling tests and finally reduced to seven basic types.

—Paul Gehris

This panel of men who have participated in the famous Indianapolis "500" auto race in one capacity or another, presented an interesting program for the Indianapolis chapter on May 6 at the Sahara Grotto. They discussed all phases of the race car construction for the first ten cars in the 1953 race and showed a full length film. They are: from left Bill Holland, driver; Joe St. Tillio, driver; Sam Hanks, driver; Harry Stephens, mechanic; Ed Walsh, owner; and Barney Christensen, mechanic. Some 145 were present for the meeting.—*Murray Davidson*

Santa Clara members shown at the May meeting include, from left: Jack McCarthy, Russ Usinger, Dr. Lawrence Cook and Bill Forbes.

Chevrolet Plant Toured by Erie Members, Guests

Erie—Automation was the keynote of the plant tour taken in May by 69 members and guests of the Erie chapter. The company visited was the Chevrolet plant at Tonawanda, N.Y., where the chapter saw raw engine block castings and component parts machined and assembled to a complete Chevrolet motor.

Guy Finout and Jack Lieser of the personnel department welcomed the group and later led an informal question and answer period. Before the tour the ASTE visitors were treated to a fine dinner provided by the firm.

—Samuel A. Fiorenzo

Peterboro Chapter Hears Norton Sales Engineer

Peterboro District members heard a talk by F. O. McIntyre, manager of the sales engineering department of the Norton Co. of Canada, Ltd., at the May 6 meeting. The subject for the evening covered crush dressing methods for multi-rib thread grinding.

Mr. McIntyre addressed the group for a short while on the applications and principles of crush dressing methods and then showed a series of slides to illustrate his discussion. A question and answer period followed.

On April 23 the chapter held its third annual ladies' night and spring ball. More than 150 couples attended the event, including guests from Toronto, Belleville, Lindsay, Oshawa, Marmora, Delora, Port Hope and Lakefield. Prizes worth over $200 were presented to the ladies, who also received roses at the beginning of the evening.

—Donald G. Moorby

Applied Hydraulics Discussed by Speaker

Los Gatos, Calif.—Highlights of the lecture on precision press brake operation presented in May for Santa Clara Valley chapter, included a background and historical briefing of the hydraulics industry. Program speaker was Russ Usinger, assistant to the president of Pacific Industrial Manufacturing Co. of Oakland, Calif.

The primary function of applied hydraulics, according to Mr. Usinger, is the safe, amazingly precise control of tremendous forces in a versatile and extremely useful shop device.

Other speakers heard by the 75 members at the meeting were Dr. Lawrence H. Cook, who talked on the ASTE industrial exposition, and William Lanyon, chapter delegate, who reviewed activities at the Annual Meeting.

—Harold Weaver

Tool Steels Topic at Louis Joliet Meeting

The regular monthly meeting of Louis Joliet chapter attracted approximately 80 at the Woodruff Hotel on May 18. The speaker was G. E. Brumbach, metallurgist from the Carpenter Steel Co., who talked on "Tool Steels and Their Applications."

The April monthly dinner meeting, also held at the Woodruff Hotel, drew 130 members and guests. Speaker on the evening's program was Edward J. Ferris, director of the machinery division of Pratt & Whitney, who gave a talk on "Accent and Accuracy," pertaining to a new jig boring machine. The talk was augmented by a film.

—Lionell Rohman

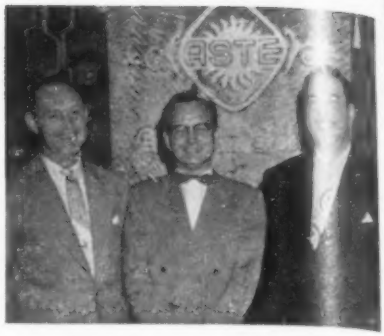
Education Chairman Reviews Scholarship Fund

Racine—Details of the $200 yearly scholarship fund provided by the Racine ASTE chapter were reviewed at the group's May 3 meeting. Byron Peterson, chairman of the education committee, led the discussion on the fund which was established to aid Racine students interested in tool engineering.

The technical program featured a talk on tracer controlled pantographic milling. Allen D. Gunderson, assistant chief engineer, George Gorton Machine Co., Racine, was the speaker.

About 125 members attended the meeting at Dania Hall.

—Alvin J. Michna



Main speaker at the April 14 meeting of the Fort Wayne was Louis Small, right, president of Service Diamond Tool Co., Ferndale, Mich. Pictured with Mr. Small, from left, are: R. L. Slaughter of the R. L. Slaughter Co., who helped in the program presentation, and Joseph Deck, first vice chairman.

Memphis Speaker Talks About Screw Threads

Memphis—Harvey G. Bass, field engineer at Geometric Tool and Greenfield Tap, St. Louis, was the speaker at the May 14 meeting of the Memphis chapter at the Shrine Club. "Screw Threads" was the subject of his talk.

Two films were also shown, entitled "Taps and Tapping Problems" and "Facts on Geometric Die Heads and Collapsible Taps." Mr. Bass discussed the new unified screw threads pointing out changes made and new tolerances allowable.

Bob McIntyre was awarded the annual award for outstanding service to the chapter during the past year.

—Frank Fly

Films Shown at Milwaukee Program

Milwaukee—"Tooling and Production of Maytag Automatic Washers" was the subject discussed at the May 13 meeting of the Milwaukee chapter. Speakers were Melvin Verson and Mr. Johnson of Verson Allsteel Press Co., Chicago. The major part of the program was presented by a sound and color film devoted to the die problems encountered in the manufacture of automatic washing machines.

A film on tool and die making, filmed for the National Tool and Die Manufacturers Association, was also shown at the meeting.

Entitled "Tool and Die Making—Keystone of Mass Production," it pictured the building of tools and showed the tools in actual use. The entire program was attended by 125 members and guests.

—Walter Behrend

Tool Steels Discussed at Niagara Program

Niagara District members heard a discussion on the properties of tool steels at their May 6 meeting. Program speaker was M. H. Johnston of Vanadium Alloys Steel Co., Latrobe, Pa. He stressed the importance of selecting the right type and grade of tool steel for each particular job.

Mr. Johnston was introduced by Ralph Meeker, and thanked by Gordon Bishop. Chairman C. R. Mitchell presided at the meeting held at the Esquire Hotel.

—William Yaeger

Chautauqua-Warren Learns About Silicones

Warren, Pa.—The Marconi Outing Club was the scene of the Chautauqua-Warren May 20 meeting. Approximately 75 members were present when Jack J. Wilson, technical sales representative of Dow Corning Corp., Cleveland, discussed "How a Tool Engineer Can Use Silicones." Mr. Wilson outlined the history and the various types of silicones. He also showed the movie, "What Is a Silicone." Erwin Slate, past chairman of the Buffalo-Niagara chapter was a guest at the meeting.

—Leslie Beaujean

Portland Film Shows History of Aviation

Portland, Me.—Winners of various vocational school contests were special guests at the May meeting of the Portland chapter. They were: Donald White, Morse High School, Bath, Me., who won the vocational contest; John Haley, Thornton Academy, Saco, Me., who won the industrial arts machinery contest; and Charles Barnes, Waterville High School, who won the drafting contest.

Technical speaker was Charles A. McKenney of Northeast Airlines. He showed a film on the history of flying, which also pictured today's jet flying.

—Henry C. Hagman

Hamilton Chapter Tours Ford Motor Company

Hamilton—The May 18 meeting of the Hamilton District chapter took the form of a plant tour at the new Ford Motor Co. plant in Oakville, Ontario. Members viewed the main line assembly starting with the roof, floor panels and door pillars being welded together through the finish of the completed products.

—G. W. Hawkes

Shown at the speakers' table at Worcester's May 4 meeting, from left, are: Vic Erickson, past national treasurer of ASTE; Andrew Peterson, chapter treasurer; J. Irving England, first vice chairman; Emerson E. Keys, merchandising manager of Simonds Saw & Steel Co.; Adam T. Kosciusko, chapter chairman; Dr. Leo P. Tarasov, secretary; Charles W. Monigle, chairman of the professional engineering committee; T. O'Neil, of Simonds Saw & Steel Co.; and George L. Gershman, chapter of the entertainment committee. Mr. Keys was the technical speaker and gave an educational talk on manufacturing saws and knives for industry. He was assisted by Mr. O'Neil. A movie in full color illustrated the program.—*John C. Lalor*

This photograph taken at the Golden Gate meeting held April 21 shows the technical speaker, Nelson G. Spoth of Kolcast Industries, Cleveland, Ohio, addressing an ASTE audience at Rickey's Stonestown Restaurant in San Francisco. He spoke on the frozen mercury process of investment casting. Slides illustrated his program. More than 100 members attended the meeting.—*Ernest Romine*

These young members of ASTE were awarded student memberships by the Evansville chapter at a recent meeting. All are outstanding students in industrial engineering at Evansville College. From left: Joe Schapiler, Dellas Graham, Richard Ettensohn, Lewis Plane and Walter Schentrup. The memberships were presented at a ceremony held at Evansville College by John Race, chairman of the chapter.

North Texas Awards First Scholarship

A highlight of the North Texas May 14 meeting was the presentation of the chapter's first scholarship. Winner of the award was John Altermann, 17, a senior at North Dallas High School. The ceremony was witnessed by 85 members and guests.

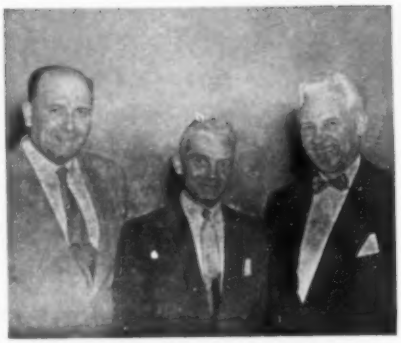
For the technical program, E. J. Vanderploeg who is chief engineer at The Yoder Co., Cleveland, addressed the chapter on the topic "Possibilities and Limitations of Cold Roll Forming." Supplemented by various slide pictures, the discussion covered the design and functioning of forming machines, as well as roll design and applications of roll forming. —*R. E. McMahan*

Windsor Again Offering Tool Design Courses

Windsor—Meeting at the Prince Edward Hotel on May 10, members of the Windsor chapter heard a talk by H. Stein of Denison Engineering Co., Columbus, Ohio. Mr. Stein spoke on the use of hydraulic presses.

A report on the die design and tool design courses being offered by the Windsor chapter was made by M. Hollo, chairman of the education committee. Both courses are conducted at evening sessions at the Ford Trade School. Divided into four semesters, each requires two years to complete. The classes on die design have been in operation for three years, while the tool design course has been offered for just one year.

Instructors are Doug Nuttall, Ed Litwin, George Harrison and Erick Millin. —*A. Underwood, Jr.*



Executives night brought L. B. Bellamy, immediate past president, on left, to the Dayton chapter as speaker. With him are Chairman Dusseau and Glen Massman.

Dayton Executives Hear ASTE Past President

Dayton—Past President L. B. Bellamy addressed 85 members and guests at the Executives Night meeting held May 10 by the Dayton chapter. Mr. Bellamy, is general manager of Sterling Abrasives Co., Tiffin, Ohio

Toastmaster for the program was Glen Massman, executive secretary of the Dayton Foremen's Club. Honored guests were introduced by Chairman R. J. Dusseau. They included many of the top executives in the Dayton area.

Past chairmen of the Dayton chapter attending the meeting, which also served as the annual anniversary get-together, were; Earl V. Johnson, George Goodwin, who is now a national director of ASTE, Herman O. Poock, Walter R. Olt, George Tillotson, Adam Lensch, Edgar J. Seifreat and Larry McAfee. A telegram was received from Past Chairman Howard C. McMillen, second vice president of the Society, who expressed his regret that he could not be present. —*W. J. Killinger*

Windsor ladies night on April 23 at Beach Grove Golf and Country Club drew a capacity crowd of 340 persons for dinner and dancing by Matti Holli's orchestra. At the head table are: from left, the W. W. Moores and the F. A. Ritchies. Mr. Moore is entertainment chairman and Mr. Ritchie is the chapter chairman.

Trends in Forging Topic at Calumet Area Meeting

Members and guests of the Calumet Area chapter met at Vogel's Restaurant on May 19 to hear E. S. Rider who's in charge of the sales and service department, National Machinery Co., Tiffin, Ohio.

Augmenting his talk on "Trends in Modern Forging,' he showed a film covering such subjects as precision maxipress forging, reducer rolling, cold and hot extrusion, hammer forging, and automatic hot upsetting. A large variety of forging samples were on display for examination by the members.

On April 21, in spite of heavy rain, 70 percent of the membership turned out to hear Dr. Harry B. Osborn, Jr., technical director of Tocco Div., Ohio Crankshaft Co., Cleveland, and first vice president of the Society. Dr. Osborn discussed "Induction Heating and the Tool Engineer."

—*L. W. Montgomery*

Scientist Talks on High-Speed Aircraft

Des Moines—"The Development of High-Speed Aircraft" was discussed by Dr. Alexander M. Lippisch, director of research at Collins Radio Co., Cedar Rapids, at the April meeting of the Des Moines chapter. An audience of more than 125 persons, including 55 student members from Iowa State College, attended the meeting at the Hotel Kirkwood.

Dr. Lippisch, German scientist who escaped from Germany during World War II, explained the fundamentals of high-speed flight and the problems that had to be overcome before it could be attained. The highly technical program, presented in a colorful manner, was highlighted by the showing of a movie taken by Dr. Lippisch of the flight of a German rocket powered Delta Wing.

—*J. J. Schlesselman*

Metallurgist Addresses Nashville ASTE Chapter

Nashville—Paul H. Stuff, chief metallurgist for Ross-Meehan Foundries, Inc., addressed the April meeting of the Nashville chapter. "Meehanite Metal for Forming and Stamping Dies" was the title of his program which included principles of heat treatment shown on slides.

Among the guests at the meeting were A. J. Edgar, Paul Gaynor, Tom Sigman, R. O. Rollins, Jr., Glenn London and Charles McBroom.

—*Harry O. Collins*

At an **international machine tool show** in Brooklyn members of the Greater New York chapter examine a single point tool for high production threading. From left are: Nat Simon, George Cole, Henry Picarelli, Tom Williams and exposition official Herb Spencer.—*Henry Picarelli*

Charter Members Honored at Rockford

Rockford—April 8 was designated as charter members' night by the Rockford ASTE chapter. Ed Dickett, the first chairman, gave a short talk on the history of the chapter and introduced the 20 charter members who were present. They attended the dinner and program as guests of the chapter.

Harry Conn, chief engineer at Scully-Jones and Co., Chicago, was the technical speaker. He talked about solving difficult tooling problems. Illustrating his talk with slides, Mr. Conn discussed techniques used by his company in overcoming difficult drilling, reaming and tapping problems.

The session was held at the Lafayette Hotel with more than 100 members and guests in attendance.

—*Les Teachout*

R. L. Gergen Speaks at Montreal Meeting

Montreal—A discussion entitled "Common Sense Gaging" was presented at the May 13 meeting of the Montreal chapter. The speaker was R. L. Gergen who is sales manager of the Gage Division of Pipe Machinery Co., Wickliffe, Ohio. More than 100 members and guests attended the session held at Montreal Technical School.

The coffee program offered a film and talk on carbide turning tools and holders presented by Rock Germain of Industrial Steel and Supply Co., Ltd.

In April Montreal members heard a speech on turret lathes by Peter H. Hansen, consulting engineer, Cosa Corp. of Canada, Ltd. —*F. C. Henderson*

Two Speakers on San Fernando Agenda

North Hollywood, Calif.—San Fernando Valley chapter met at Hody's Restaurant on May 5 to hear two speakers. Fred W. Witzke, product supervisor at Brush Electronics Co., talked on "Surface Finish Instrumentation," while Ashley Hollingsworth, project engineer at Magna Engineering Corp., in Menlo Park, Calif., presented a film on "The Magna Drill."

On April 7, R. A. Quadt was the technical speaker. Mr. Quadt, director of research and development of the Hunter-Douglas Corp., Riverside, Calif., showed a film and talked on "Cold Forging of Strong Aluminum Alloys."

R. A. Quadt **H. T. Young**

Also on the program was a film entitled "Precision Parts from Powdered Metals,' shown by Messrs. French and Kurphy of Kwik Set Lock Co.

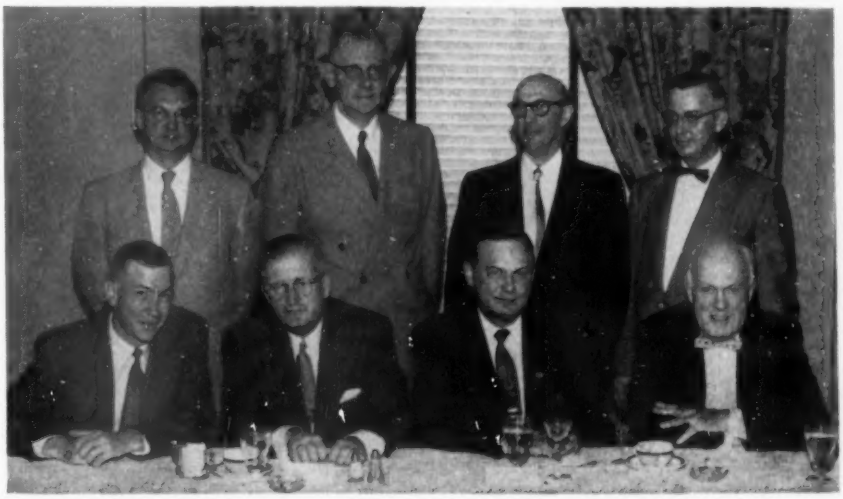
—*A. J. Soares and Gary Diamond*

Canadian Film Seen by San Diego Members

San Diego—A film sponsored by the Southern Equipment Co., "The Man with a Thousand Hands," was shown at the April 13 meeting of the San Diego chapter. Filmed in British Columbia, Canada, the movie pictured the opening of new territory for mining and manufacturing aluminum and the building of power facilities and roads in the Canadian wilderness.

ASTE emblem pins were given to new members of the chapter by Walter Hostetler, second vice chairman. The dinner meeting was held at the El Morocco Cafe and attended by 90 members and guests.

—*William Keller*



Cincinnati chapter's annual dinner meeting was held in the Marie Antoinette Ball Room of the Hotel Alms. Speaker of the evening was C. A. Harrell, city manager of Cincinnati. Seated from left are: John Elfring, first vice chairman; Mr. Harrell; J. C. Maezer, chairman; and Guest Judge James Garfield Stewart of the Ohio Supreme Court. Standing are: Julius Steinhoff, treasurer; Richard Neibusch, national delegate; Dr. Max Kronenberg, second vice chairman; and Moler Duff, Jr., secretary.

—*Frank Houston*

Dr. Harold Frommelt, well-known consulting engineer, points out an interesting aspect of a demonstration on high speed milling during a tour of the Gleamer Harvester Co., Independence, Mo., by Kansas City ASTE chapter members.

Hydraulic Presses Topic at Columbus Meeting

The May 12 meeting of the Columbus chapter took place at Presutti's Villa Restaurant. The technical speaker was John R. McCutcheon, assistant manager of the Metal Division, H. P. M., Mt. Gilead, Ohio, who talked on "Large Hydraulic Presses."

On March 10, the chapter held its annual executives night at the Columbus Athletic Club. Highlight of the evening was an address by Tell Berna, general manager of The National Machine Tool Builders Association. The toastmaster was Bernard Hodapp, past president of the National Association of Foremen, who introduced the coffee speaker, Dean Carson, of Ohio State University's engineering department.

New officers of the Columbus chapter are: chairman—Jay N. Edmondson; first vice chairman—Henry M. Curl; second vice chairman—Marlin A. Schueler; secretary—Arthur B. Gangloff; treasurer—Sheldon W. Cox; delegate—Emmett A. Bartlow; and alternate—Howard F. Volz.—*M. D. Sherman*

Grand River Valley Holds Ladies Night

May 7 was the date of Grand River Valley's fifth annual ladies' night party. Chicken dinner, dancing, and entertainment by 'Lefty' Weichel made up the successful program. More than 400 members and their guests attended the event at Leisure Lodge. Prizes went to Mrs. Jack Raycroft, Mrs. Orville McKenna and Miss Merner.

—*W. C. Little*

St. Louis Plant Visited by Springfield Chapter

Springfield, Ill.—Wagner Electric Company was the destination of 124 members and guests of the Springfield chapter who traveled by buses to St. Louis, Mo., for the May 4 plant visitation. They were greeted by G. M. Daily, plant engineer, and heard a brief talk by G. A. Waters, vice president in charge of manufacturing. Dinner was provided for the group in the company cafeteria. —*Charles Collier*

ASTE Officer Addresses Kansas City Chapter

Kansas City—Dr. Harry B. Osborn, Jr., first vice president and a national director of ASTE, was the guest speaker at the May 3 meeting of Kansas City chapter. Dr. Osborn, technical director of the Tocco Division of Ohio Crankshaft Co. in Cleveland, spoke to the group of 50 on "Induction Heating."

Mr. William Spann, member of the board of examiners of the Missouri Society of Professional Engineers spoke to the assemblage on the function of the society.

On May 14, the Kansas City student affiliate chapter at the University of Kansas installed its new officers in ceremonies at the Student Union Building at Lawrence. The chairman's gavel went to newly installed Donovan Hill, who will lead the chapter in its activities for the coming year. Prof. E. C. Buehler of the college speech department, addressed the group on the importance of speech in communicating thoughts and ideas.

On April 7, Dr. Harold Frommelt was the guest speaker at a meeting held at the Rockwood Country Club. A record crowd of 400 attended to hear his version of "The Future Mill." Dr. Frommelt, a consulting engineer, was formerly head professor of mechanical engineering at Marquette University.

—*Richard W. Corliss*

Paul W. Polk Elected Company President

Paul W. Polk was elected president of the Threadwell Tap and Die Co., Greenfield, Mass., a subsidiary of Sheffield Corp. in Dayton, Ohio, at the recent meeting of the company board of directors. Mr. Polk is a member of the Springfield, Mass., chapter.

It was installation night for the Columbus chapter on March 10. Howard Volz, past chairman on the extreme right, swears in the officers who are: from left, Sheldon W. Cox, treasurer; Arthur B. Gangloff, secretary; Martin L. Schueler, second vice chairman; Henry M. Curl, first vice chairman; and Jay N. Edmondson, chairman. Tell Berna, general manager of the National Machine Tool Builders Association, who was the speaker, is seated at the head table. Pictured on the right are the Columbus officers chatting with the coffee speaker, Dean Gordon B. Carlson of Ohio State University.

Past chairmen of the Rochester chapter who were on hand for the chapter's Past Chairmen's Night on May 3 are: front row, from left, D. Kohler, C. DeMartin, J. Horne, M. Roessel and E. Moore. In the back row are: C. Codd, C. Licas, C. Sears, C. Newton, E. DeBisschop and C. Seeley.

Evansville Awards Five Student Memberships

Evansville—Five student memberships in the Society were awarded to outstanding industrial engineering students at Evansville College on May 18. The Evansville chapter sponsors these awards every year. John Race, chairman of the chapter, presented the memberships to Richard E. Ettensohn, Dellas R. Graham, Lewis D. Plane, Joseph Shapiler and Walter H. Schentrup.

On May 12, some 110 Evansville members and guests assembled for a program which was a panel discussion. The subject which the panel took up was "Automation, When and Why." It covered automation in regards to drilling, milling and welding which would be applicable to local industry. It was supplemented by films and illustrations.

The panel members were: Fred Zapf, vice president of Verson Allsteel Press Co.; R. J. Peck, chief of sales, Seneca Falls Machine Co.; R. L. Barry, field engineer for Avery Drilling Machine Co.; Herman J. Muehlbauer, assistant production engineer, Seeger Refrigerator Co.; and J. E. Novack, supervisor of mechanical engineering, International Harvester. *—Guenther F. Wulf*

Plastics in Tooling Topic at Binghamton

Binghamton — Russell Houghton, president of Houghton Laboratories at Olean, N. Y., was the technical speaker at Binghamton chapter's May meeting. His talk on "Plastics in Tooling" covered the practical applications in use today and some of the possibilities in the future. *—Paul J. Adamek*

Steel Firm Toured by Tri-Cities Chapter

Rock Island, Ill.—After a report on the 1954 Annual Meeting by Robert Cannon, chairman of the Tri-Cities chapter, members attending the May meeting heard a talk by Mr. Thorpe of Allegheny Ludlum Steel Co. His program on stainless steel included a film on "Welding of Stainless Steel."

For their April meeting, 116 members and guests traveled some 50 miles to Sterling, Ill. for a plant tour of the Northwestern Steel and Wire Co. Of particular interest was the firm's electric furnace steel plant. Here were seen two of the largest carbon electrode arc furnaces in existence, each with a capacity of 50 tons.

Also visited was the company's wire manufacturing plant, where all varieties and gages of fencing wire, screen and poultry wire, agricultural wires and nails are made. The extremely specialized tooling required for this type of manufacturing was particularly interesting. *—Clifford C. Vogt*

Automation Urged by Rochester Speaker

Rochester, N.Y.—With 175 members and guests present, the Rochester chapter honored its past chairmen at a meeting on May 3 held at Barnard's Exempt Club. A moment of silence was observed in memory of the chapter's past chairman, Joseph Schick.

Donald Kohler was presented with the traditional past chairman's pin and reported on the House of Delegates meeting in Philadelphia. James O'Horn, newly elected National Director of ASTE, then thanked the members for their support.

Guest speaker for the evening was Charles Hautau, chief engineer at Hautau Engineering Co., Detroit, who voiced the prophecy that high production product manufacturers utilizing standard machine tools would have to close up shop shortly unless they beat their competitors to the punch through the medium of automation. He cited examples of well-known manufacturers that were almost forced to close overnight or turn to automation in order to reduce their cost for the competitive market.

On April 5, Rochester members and guests assembled to hear Charles Shepard, patent attorney from Rochester, who talked about the steps leading to patenting an invention. William Kamola was presented with the ASTE service pin. *—Paul Bruno*

Carl Oxford Elected to Board of Directors

Carl J. Oxford has been elected to the board of directors, National Twist Drill & Tool Co., Rochester, Mich., according to an announcement by Howard McGregor, company president. Mr. Oxford, a member of the Detroit ASTE chapter, has been chief engineer of the company for more than 30 years.

Education night on Evansville chapter's calendar was arranged by Ed Seibert, chairman of the chapter education committee, on the extreme left. Other principals participating in the program were: from left, Harry Thompson, Prof. Dean Long of Evansville College, and John Race, chapter chairman.

Scholarship Program Planned by Little Rhody

Providence—Plans for awarding cash scholarships and *Tool Engineers Handbooks* were announced at the May meeting of the Little Rhody chapter. An essay contest will be sponsored next fall for students and apprentices taking approved courses of training to determine the recipients of the awards. Winners of the competition will be able to apply their prizes toward furthering their education.

Technical speaker at the meeting was Thomas A. Monahan, director of the Rhode Island Development Council and president of the Providence Body Co. His topic was "The Industrial Future of Rhode Island." Outlining the organization and purpose of the Development Council, Mr. Monahan described the progress being made in diversification of industry in the state and discussed the continuing expansion programs being carried out by industrial firms.

—Richard Kilbane

Lima Past Chairman Speaks at Local School

Opportunities in the field of tool engineering was the theme of a talk given by Raymond Schimpf, past chairman of the Lima chapter, to the junior and senior members of the Lima Vocational High School. He stressed the importance of mathematic fundamentals. Burton Schwartfager, chairman of the education committee, presented the school with a copy of the *Tool Engineers Handbook* on behalf of the Lima chapter.

On May 20, some 46 members and guests were present for a meeting in the Royal Pine Room to hear K. H. Kuhlen, sales manager of the Amplex Division, Chrysler Corp., discuss the powder metallurgy process.

Guests present were: Larry Borchers, Art Rose and Art Hedges of Bearings, Inc.; C. E. McBride and Chester A. Johnson of Westinghouse Electric.

Two new members were introduced to the chapter, who are: Hugh L. Simpson of Simpson Steel Co.; and Theodore R. DeLong of Stewart Machine Works.

April activities were rounded out by a plant visitation at the New Idea Division of Avco in Coldwater, Ohio. Approximately 50 members and guests attended. E. J. Humboldt, plant manager, welcomed the group and basically outlined operations at the plant. At the completion of the two-hour tour, each guest was presented with a miniature model #30 Mower.

—Donald Cox and Louis Heyne

John A. Harrington addressed the Toledo chapter and conducted a stimulating discussion on precision measurement.

Chief Engineer Talks on Precision Measurement

Toledo—From a vast store of experience in the development of theories, equipment, and techniques in the precision measurement field, John A. Harrington, chief engineer of the DoAll Co., addressed the April meeting of the Toledo chapter on the topic "Precision Measurement—Theory of Dimensional Control and Practical Applications."

The body of the talk was used in describing and illustrating the proper use of instruments, statistics, and material selection for producing gages that are true standards.

One of the highlights of the question period was a statement of the trends of the future in precision measurement.

—Carl W. Hoglund

ASTE Chapters Tour Marlin-Rockwell Plant

At a joint meeting of the Buffalo-Niagara Frontier and Chautauqua-Warren chapters held in April, nearly 225 ASTE members toured the new precision bearing plant of the Marlin-Rockwell Corp. at Falconer, N.Y. The program included dinner served at the plant cafeteria and a technical address by Elbert W. Garrison, quality manager for the plant.

Mr. Garrison described the manufacture of ball and roller bearings, outlining the various operations the group would see on its tour of the plant.

The ASTE chapters were welcomed by Herbert Cave, factory engineer at Marlin-Rockwell, and chairman of the Chautauqua-Warren chapter. He introduced Charles Oliver, head of the Buffalo-Niagara Frontier chapter, who expressed the appreciation of ASTE for the opportunity to tour the plant.

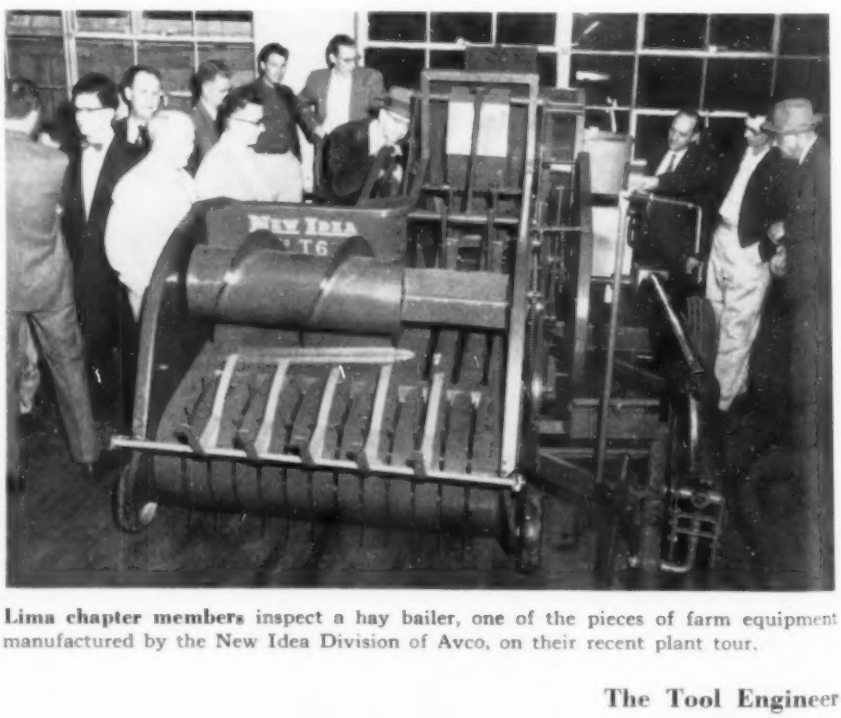
Much interest was displayed during the tour in the broaching operations and the varied methods of grinding, gaging and assembly.

—L. H. Beau Jean and A. W. Miller

Spring Picnic Tops Nashville Agenda

Nashville—It was family day when members of the Nashville chapter gathered at Shelby Park for their annual spring picnic. A complete program of sports, games and eating made the day a memorable one. They played softball, pitched washers and sat down to a supper prepared by the ladies.

—Harry O. Collins



Lima chapter members inspect a hay bailer, one of the pieces of farm equipment manufactured by the New Idea Division of Avco, on their recent plant tour.

Attending the combination past chairmen's night and 'bosses' night held by Madison chapter at the Ace of Clubs were: from left, Jack Murray, chapter chairman; Dean Wendt, University of Wisconsin; Arnold Wendt, University of Wisconsin; Robert Eckl, Ampco Metal; Roy Lindberg, University of Wisconsin; Oscar Frohman of Ampco; Edward Helmke of Gisholt, past chairman; Gordon Brown of Ampco; Fred Kessimick of Fred Kessimick Co., past chairman; and George Sell of the University of Wisconsin.

Piedmont Holds Annual Dinner Dance

Winston-Salem, N.C. — Piedmont chapter's meeting for May was strictly social, with 100 members and guests attending the group's annual dinner dance at the Thomasville Women's Club. In charge of the event was the entertainment committee headed by Daniel G. Gill. The evening's program included a fine dinner, awarding of many prizes, dancing, bridge and canasta. *—Howard A. Longfellow*

Industrial Drilling Topic at Tucson

Tucson—Marco's Restaurant was the scene of the May 11 Tucson chapter meeting. Some 65 were present to hear Ashley Hollingsworth's presentation of the film "New Concepts of Industrial Drilling." Mr. Hollingsworth, project engineer at the Magna Engineering Corp. of California, demonstrated various setups possible for different types of jobs using a scale model of his company's drilling machine.

Guests at the meeting included: Lynn F. Boothe, part owner of Joseph M. Doebrick and Co. of Tucson; Ralph Talley, Karl Kasse, Don Clayton, Stan Radke, and Jacob Yovanov, all from Hughes Aircraft; and Paul Sagady, who recently transferred to the Tucson chapter.

On April 13, the chapter's regular meeting featured a talk by Philip Tarr, chief engineer and general manager of Kwikset Powdered Metal Co. Special guests at this meeting were professors and students of the University of Arizona. Ninety-four attended the session. *—Joseph W. Vincent*

Madison Honors 'Bosses' and Past Chairmen

Madison—April 15 was past chairmen's night and also bosses' night for the Madison chapter. About 55 members and their guests attended.

Guest speaker was R. C. Max, engineer in charge of the western regional office of the Factory Insurance Association. He showed movies of last year's disastrous fire at General Motors Livonia, Mich., plant.

Announcement was made of the new committee chairmen. They are: Charles A. Gilpen, professional engineering; Roy Lindberg, education; Walter Hougas, advertising; Norman Rinden, membership; Lyding Havey, public relations; Edward Huettner and Edward Skidmore, welfare and attendance; Leon Bellefeuille, constitution; Joseph Kellog, standards; and Arthur Collins.

—Lyding Havey

Plant Tour Main Event on Houston Calendar

Houston—A tour of Mission Mfg. Co. was in order for some 180 members of the Houston chapter on May 11. The company is a manufacturer of oil slush pump parts including pistons, rods and seats and liners. The tour was conducted through all stages of their manufacture.

The group was especially impressed with the research setup and testing equipment for centrifugal pumps and their extensive use of mechanical equipment for work handling.

At another meeting of the chapter held at the Ben Millam Hotel, 150 members and guests heard a talk by James Meehan of Brown & Sharpe Mfg. Co. His topic was "New Developments in Design of Grinding Machines." A special guest of the chapter during the evening's program was Dean M. L. Ray of the College of Engineering, University of Texas.

Cigaret lighters were presented to Homer Briggs and Morris Dale for bringing into the chapter three new members each. *—Virgil Ferguson*

University Site of Nebraska Meeting

Lincoln, Nebraska—Members of the Nebraska chapter report one of the finest meetings in their short history was held May 20 at the Student Union Hall on the campus of the University of Nebraska.

On the evening's agendum was a film on "Research in the Field of Metal Turning," and an informative talk by Sam Grasso on the ASTE Exposition in Philadelphia. Mr. Grasso attended as a delegate. *—T. C. Jones*

At the Tucson meeting are: from left, Lester G. Detterbeck; Ashley Hollingsworth, project engineer of the Magna Engineering Corp., who was the evening speaker; Robert Pyers; and Jim Matthew. This session was held at Marco's Restaurant.

news in

METAL WORKING

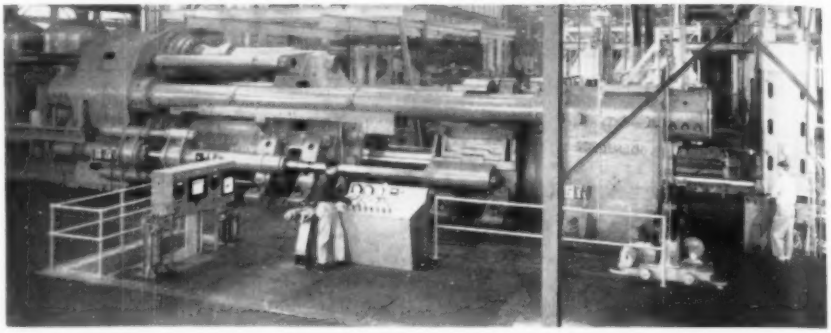
GIANT EXTRUSIONS ROLL FROM HEAVY PRESSES

Production connected with the multi-million-dollar U. S. Air Force Heavy Press program begins with the operation of the 14,000-ton press at Aluminum Co. of America's Lafayette (Ind.) Works. This is to date the world's largest press for the extrusion of metals. Two and a half times as powerful as existing extrusion presses in this country, the unit will form four times the weight of aluminum previously possible in a single "squeeze."

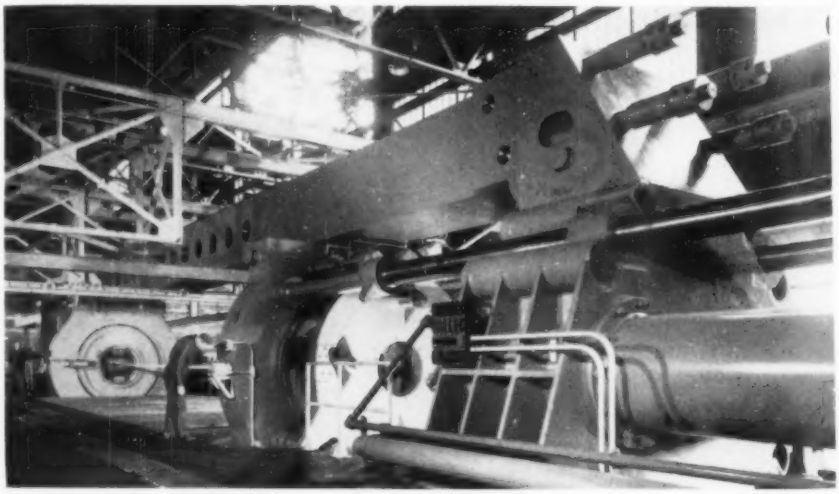
Heated ingots feed automatically into the big press and are extruded through its dies onto a long runout table, attached to the extrusion die holder. Runout table and die are moved forward hydraulically so that the butt end of the ingot can be sheared off.

Following treatments to improve strength, the extrusion is stretched to remove distortion and relieve stresses built up during production operations, cut to required length by a giant 96-inch saw, and heat treated in an aging oven.

With this combination of equipment, extrusions are possible that weigh as much as 2500 lb and measure as long as 110 ft. per piece.



This Schloemann-made press, started for German war use, was redesigned for American production. Parts finished from these extrusions will replace with a single piece, aircraft sections formerly made of many small parts.

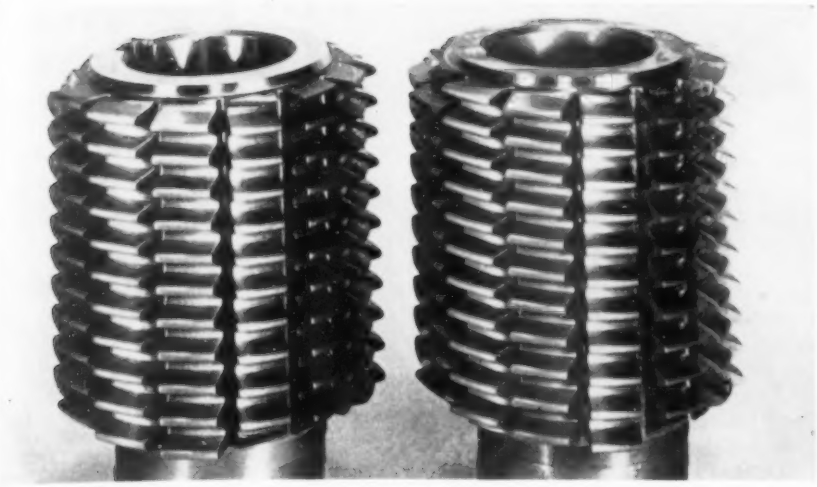


Right: This 3,000,000-lb stretcher, which takes extrusions as long as 110 ft from the big press, is capable of straightening 75S up to 60 sq in. in cross section area.

AUTOMATED LINE SPEEDS MACHINING

Four transfer machines, designed and built by Greenlee Bros. & Co., form an automatic production line for machining automotive transmission cases. Their facilities of 247 tools combine to complete 265 operations in less than 30 seconds. Output of the line is an average of 122 cases per hour at 100-percent efficiency.

Prime among the machines' features are the various safety devices. An emergency cord at each machine permits stopping of the machine from any position along its entire length. All functions of the units are hydraulically operated and electrically interlocked. Malfunction is quickly detected and trouble located immediately by a system of lights mounted on the operator's control cabinet.



At left, two gear hobbing cutters offer an opportunity to compare examples of the two steels. The cutter on the far side was made of regular steel, while the nearer one was made of steel with sulphide additives. Note the smoother finish on the backoff edges of the XL steel tool.

SULPHUR IMPROVES TOOL STEELS

Sulphide additives to all grades of high alloy tool steels have been perfected by Latrobe Steel Co. to improve the properties of these steels. With these additives both high-speed steel (XL) and die steels (FM) have improved machinability and self-lubricating qualities. Tool life is increased as much as 100 percent and better finish results. At the same time, mechanical properties and heat-treatment specifications are unaffected by the additives.

In this process, sulphur is added to the steels during the melting process, where it reacts with other alloying elements to form sulphides which are intimately associated with the carbide particles and dispersed as minute quantities throughout the steel. The additives do not affect chip formation, but act as a lubricant to reduce friction in the cutting process. In fact, this dispersal brings the sulphides directly to the cutting edge of a tool without impairing its cutting strength.

Betters Performance

Comparative performance tests between the steel with the additives and steel of the same analysis without sulphides, indicate that the former grade can be machined twice as fast as the plain grade for a given tool life. For example, for a 60-minute tool life, the cutting speed for plain steel is 30 fpm while it is 60 fpm for the improved grade. In other tests, 1.50 C-12.00 Cr, D-2 type steel was machined up to 100 percent faster with the sulphide additive.

This process is the result of a project aimed at overcoming difficulties associated with form relieving of gear hobs. These problems were great enough to have caused some manufacturers to specify semihard forgings in an effort to prevent tearing during the form relieving work, thus obtaining a better finish.

As to success of the work, a gear hob manufacturer reports that in backing off hobs of regular stock, one hob per tool sharpening has been considered satisfactory; but five hobs made with the new stock can be backed off before tool re-sharpening is necessary.

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MACHINING TUNGSTEN

High density tungsten can be machined with ordinary cutting tools or shop equipment to tolerances comparable to those possible for steel or brass by means of a process, called Porphil, recently perfected at Philips Laboratories, Inc.

High temperature sintering, with concern for tungsten powder characteristics, pressure used in forming the ingots and the dew point of the sintering atmosphere, gives the desired physical characteristics of the sintered tungsten ingot.

Impregnating metal acts as a filler and lubricant and prevents tearing out of particles, burnishing and excessive tool wear which ordinarily occurs. Since the operation precedes machining, it avoids an old problem of distortion and warping which was produced in the tungsten ingot by sintering. Further, the process temperatures used to add and remove the wetting metal and the application temperatures are well below sintering temperature; they therefore have no effect on the final shape, tolerances or physical characteristics.

Machining is relatively easy in the case of densities up to 83 percent, however, tungsten parts with a density value as high as 90 percent of theoretical value may now be fabricated.

HARD SURFACING TO 'PAINT' ON

Hardness and abrasion-resistance qualities equal almost to a metallic tungsten may be given to any surface as a result of a development by The Lockrey Co., Southampton, N. Y.

The substance, called Tungstide, consists of metallic tungsten of near colloidal, partical particle size suspended in a very hard liquid plastic. Into this combination is added a hardening form of the company's Liqui-Moly, a lubricant possessing anti-seize and anti-scoring properties.

Present applications under test include those where a case-hardening effect is desired on brass, plastics and other softer materials.

The substance is available in differing formulations for various uses. All grades are water and solvent-resistant, and may be applied to any clean surface of the appropriate material. Where extreme dimensional accuracy is important, the Tungstide coating may be brushed directly on the inner surface of the mold itself and cured integrally with the casting resin poured against it so that the casting comes from the mold with the hard-surfacing incorporated into the cast part.

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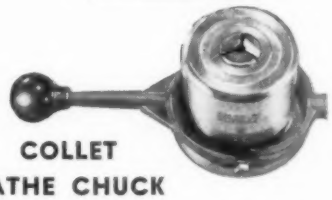
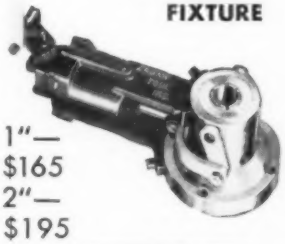


COLLET LATHE CHUCK

1"—$125 2"—$185

AIR-OPERATED FIXTURE



1"—$165
2"—$195

VERTICAL-HORIZONTAL FIXTURE

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2"—$185

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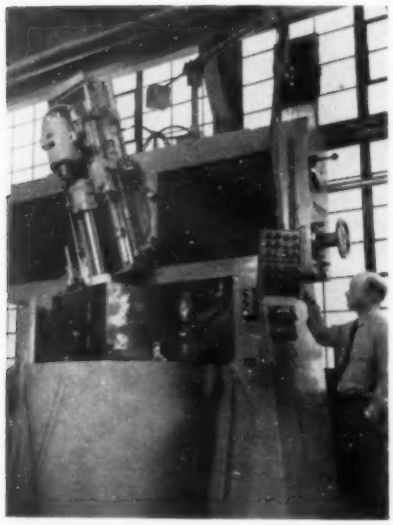
INDICATE A-7-110-2

TOOLS of today

Universal Grinder

A hydraulically operated vertical universal grinding machine, the Model 3-TR, has been introduced by The Springfield Machine Tool Co., Springfield, Ohio. Prime advantage of the unit is that it can do simple or complex work and can accomplish multiple operations with one chucking. Using only the standard single head, it finish grinds mating parts with a single angle setting. The angle may be up to 45 deg.



Nominal swing of 42 inches and a normal maximum of 52 inches, which in special setups can be extended to 60 inches, indicates the unusual capacity of the machine.

By addition of other grinding heads and accessory side heads, the unit can be made to handle complex jobs in an abbreviated length of time. Possible cylindrical grinding work includes OD, ID, face surface and angle. Side heads permit surface grinding simultaneously with other operations.

Operating controls, such as pushbutton and selector switches, are mounted on a pendant station which can be raised or lowered and moved to suit the operator. Other controls are grouped at the right side and corner of the housing.

Speeds in the work spindle and cross slide rapid traverse are infinitely variable.

All features for the grinder are designed to facilitate ease of operation, simplicity of setup, durability and rigidity and reliability.

In addition to a line of standard regular accessories for the machine, special accessories to meet unusual needs can be built for the 3-TR grinder.

T-7-1111

Plastics for Tooling

Improved metal-containing resins have been developed by Aries Laboratories, Inc., 270 Park Ave., New York 17, N. Y. for use in industrial tooling.

The material, called Plasti-Metal, is said to combine the manufacturing ease of cast plastics with strength and dimensional stability of metals with excellent wear resistance and tool life. No pressure is required for curing which is accomplished at moderate temperatures. If necessary, tools of the material can be heated up to 280 F.

Both casting and laminating techniques may be used to shape the material into complex parts. Conventional metalworking methods accepted for nonferrous metals may be used. Electroplating is practical on parts made of special formulations of the material.

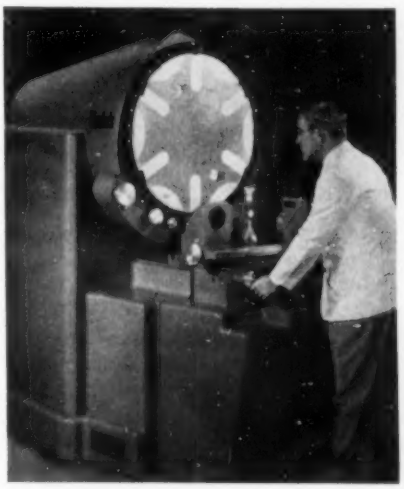
Further information and data sheets are available from Aries. **T-7-1112**

USE READER SERVICE CARD ON PAGE 135 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

30-Inch Contour Projector

A 30-inch viewing screen is featured in the recently introduced Model 30 contour projector by Eastman Kodak Co., Rochester 4, N. Y. The unit, which is suitable for either precision micrometry or production line work, permits easy inspection of complete parts and particular convenience in inspection portions of very large parts.

It offers choice of either shadow or surface illumination; ordinary room-light operation; instant changes in magnification without refocusing; and unvarying 8-inch distance between lens and plane of the object under observation. Pertinent features include a staging area with a 17-inch throat; 8-inch horizontal and 8-inch vertical table travel; built-in helix table has a work-table rotation of 15 deg. off center in either direction for setting helix angles; horizontal and vertical micrometers are guaranteed to 0.00005 inch over their entire 1-inch range; angular measurements may be taken from a direct reading screen. **T-7-1113**



Form Relief Grinder

This unusual grinder introduced by Royal Oak Tool & Machine Co., 29800 Stephenson Hwy., Royal Oak, Mich., can produce axial relief only, radial relief only, or any combination of the two. Simplification of the setup and operation is a major advantage that means form relief can now be made a standard grind for most end and side cutting tools.

Of particular importance is the fact that the tool motion is on a plane rather than oscillating into the wheel. The tool neither moves above nor below center on the wheel, but moves into the wheel on center for the entire grind with consequent better control and avoidance of vibration.

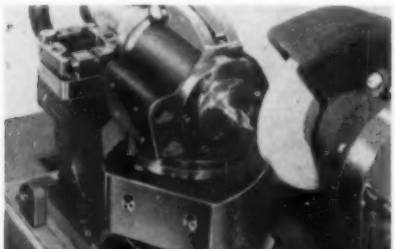
Activation is by means of fast interchangeable cams. The cam follower is attached to one end of a pivoted bell crank; a plunger on the opposite end forces the spring loaded fixture along the ways. Full 90-day adjustment of the ways unit controls the direction of travel into the wheel, so that any relief can be accomplished.

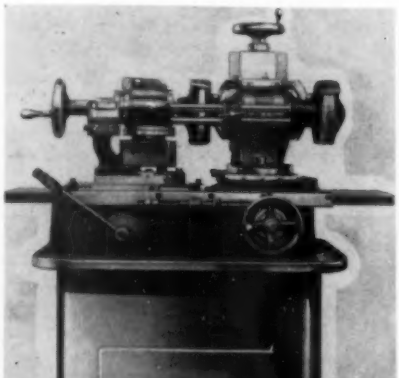
Five selective pivot points on the bell crank enable the operator to relieve varying amounts with any cam of one to 16 impulses. For cam change, only one minute need elapse.

In addition, circle grinding can be performed on the unit by merely turning a knurled thumb screw which releases contact of the follower on the cam. An illustrated brochure gives complete details. **T-7-1121**

At right, the specifically designed grinder is shown with the form relieving attachment.

Below, the carriage has been turned and is now set up for a combination radial and axial relief work.





Portable Band Saw

An electric metal cutting band saw that is completely portable is offered by the Porter Cable Machine Co., 31 Exchange St., Syracuse 8, N.Y.

The unit, identified as Model 524 Porta-Band Saw, is little larger than a hand hack saw, although actual test proves it to be 15 times faster. Its stock-cutting capacity is up to 3¼ by 4¼ inches, which is equal to a large hack saw. It can be used by inexperienced workers on ferrous and nonferrous metals, plastics and other materials with speed and accuracy.

Only 16 pounds in weight, the saw avoids both weight and bulk, a handicap of previous units. It can be operated easily in any position, whether overhead, vertically or within ¼ inch of flush with the floor.

It utilizes a ½ hp motor. Band speed is 240 surface fpm under load. The continuous flexible blade is 0.020 inch thick, 44⅞ inch long and ½ inch wide. Blades are available in a range of 6 to 32 teeth per inch for all types of cutting. **T-7-1123**

Hydraulic Tracer

General purpose lathes may be converted into contouring production machines with the Trace-O-Matic hydraulic tracer attachment designed by Axelson Mfg. Co. Div. of Pressed Steel Car Co., Inc., 6160 S. Boyle Ave., Los Angeles 58, Calif. Addition of the attachment to heavy duty lathes permits a variety of work to be handled economically. Installation is merely a few hours work, and reverting the tool to a standard lathe is but a matter of minutes. Operation requires no special skill or training. The unit does not restrict swing or capacity of the lathe and also full speed and power of the lathe may be utilized. Although any type of tool bit may be used, single point tungsten carbide are prefered. Form cutters are not necessary.

Parts are duplicated from flat, inexpensive templates which can be put on the machine and positioned for the work at hand in a few minutes, serving for both roughing and finishing work. Since the stylus exerts only ounces of pressure, hardened templates are unnecessary.

Built-in micrometer adjustments for diameter and length controls offer flexibility and operator convenience in making setups.

All classes of work with uninterrupted cuts are handled automatically, to close tolerances. After setting up the

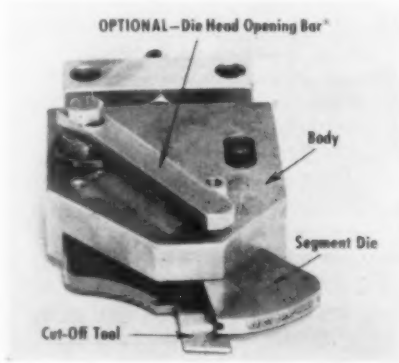
Automatic Marker

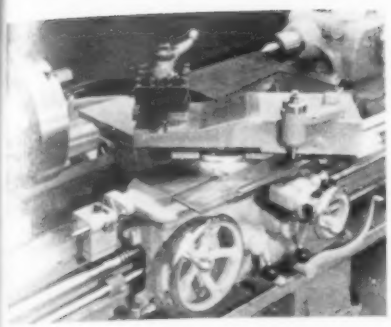
A dual-operation screw machine tool, the model 700, that performs marking and cutting off on automatics is announced by New Method Steel Stamps, Inc., 147 Joseph Campau, Detroit 7, Mich. and can be used in conjunction with almost any suitable screw machine tool.

It offers the operator an extra station on his machine to perform necessary work, and permits greater production by reducing the length of the machining cycle. By combining marking with cutting off operation, the dwell normally required for swing marking is eliminated, while marking during the screw machine cycle avoids need for secondary marking operations.

The die used for marking is a segment and is carried clear of the part after marking while the cutoff tool continues its operation to completion. Marking can be performed at any point in the automatic screw machine cycle as long as the marking surface is at its final diameter.

A starting cam on the segment die controls depth of the marking impression. Since the cam extends some distance ahead of the first character, marking depth can be varied by adjusting the point of contact of the part with the starting pad. **T-7-1121**





machine, operation is merely a matter of loading the machine and unloading. An infinite number of operations can be performed from a single setting of the compound tool slide, which can be set to any angle in a 360 deg arc. Any desired taper or length of taper within the capacity of the machine can be cut with the attachment.

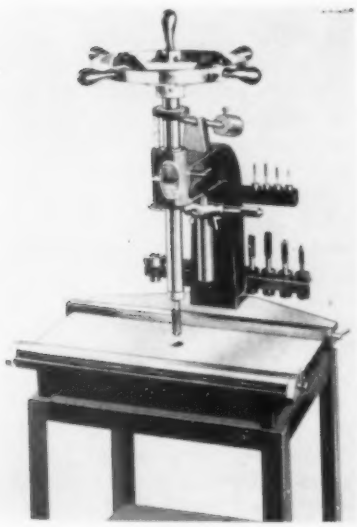
An informative bulletin may be obtained from the Division. **T-7-1131**

Spindle Balancer

Lassy hand tapping machines are now equipped with a spindle balancing device developed by Lassy Tool Co., Plainville, Conn. The balancing attachment offsets the weight of the spindle assembly and operator's hand which tends to force the tap. It is readily adjusted to compensate for various size taps and differential in the operator's hand pressure. The balance weight is set so that a slight downward pressure starts the tap cutting; when retracted, the tap floats free, leaving the top thread undamaged.

For machines already in use, the balancer can be attached simply with the addition of two holes drilled in the arm bracket to accommodate 8-32 screws.

T-7-1132

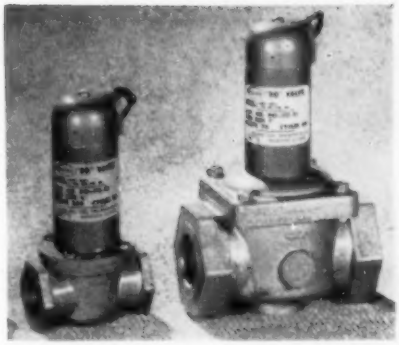


Solenoid Valves

Production of a complete line of DO (diaphragm operated) solenoid valves for stand-by control of fluid flow and for automatic cycling operations on machine tools and metalworking equipment, is announced by Eclipse Fuel Engineering Co., 1011 Buchanan St., Rockford, Ill.

The DO valves which may be used to control air, water, oil, refrigerants, and various gases, will operate on line pressures as high as 150 psi and as low as $\frac{1}{2}$ in. of water. Their ideal cycling range is from 40 to 60 cycles per minute. Those for gas and air service are supplied with aluminum bodies, while those for oil and water service come in brass.

Their operating advantages include low power consumption, simple construction, coil interchangeability, high operating efficiency, wide choice of control, maximum shut-off safety and ease of maintenance and noiseless operation.



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do jobs too tough for HSS, not tough enough for Carbide
New CIRCOLOY Combines Advantages of other steels in general use
Fills the performance gap between carbide and high speed steels — lets you restrict use of carbide and HSS to uses they serve best.
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New to market, but proved efficient and economical in production tests for over 1 year in plants all around the country.
Circoloy metal cutting saws, thickness 1/16" to 1/4", now offered in same line as our regular HSS circular cutting tools.
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the pilot-operated valves, with power required only to lift the solenoid plunger. Design of the rubber diaphragm permits fast valve action with a minimum of pressure drop. The valve will open to allow full line pressure, and will close tightly on line pressures as low as ½ in. in water. A by-pass port in the diaphragm creates pressure imbalance on the diaphragm for both opening and closing operations.

Although power is required to hold the valve open, it will close automatically in case of current failure.

Service may be accomplished without removal from the line. **T-7-1141**

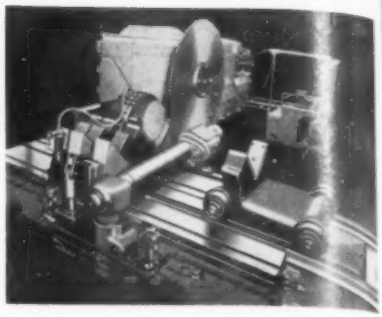
USE READER SERVICE CARD ON PAGE 135 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Circular Sawing Machine

Still a larger model has been added to the line of circular sawing machines made by The Motch & Merryweather Machinery Co., Penton Bldg., Cleveland 13, Ohio, for cutting off ferrous or nonferrous materials. This No. 5 model will cut stock up to 43 inches in diameter.

In the nonferrous, low-speed type pictured, the saw carriage is mounted on a heavy base at right angles to a heavy tee-slotted supporting table. The single speed saw carriage has feed variations available through either sheave or gear changes. The saw head is powered by a 30-hp 900-rpm motor connected by multiple belts and sheaves to the gear train. The final spindle drive has large, heavy-duty herringbone gears.

Stock to be cut is placed in the vee block and clamped. An elevating roller



moves the stock forward and power is applied by a gearhead motor. Two hydraulic cylinders elevate the roller with a heavy-duty dolly mounted on rails adjacent to the work-holding base providing additional support. **T-7-1142**

Low-Cost Self-Locking Machine Screw Nuts

Patent is pending on a line of self-locking machine screw nuts, developed by Jacobson Mfg. Co., Inc., Kenilworth 9, N. J.

Not only themselves economical in cost, these stop-nuts require no lock washers. Double chamfered and countersunk, the Jacobson self-locking nuts may be assembled either side up for automatic hopper assembly. Manufactured in one piece—all metal, they appear to be immune to the effects of oil or water. In addition, they will maintain locking action after repeated use, and will lock in any position on the thread.

Cold formed for uniformity and strength, they are available in steel, brass and aluminum, in all machine screw sizes. **T-7-1143**

Automatic Flux Valve

Several advantages are offered with the design of an automatic flux valve by The C. B. Herrick Mfg. Corp., 1935 Euclid Ave., Cleveland 15, Ohio. Since it gives positive control of the flux flow on automatic submerged arc welding applications, there is no waste of flux and there is no possibility of the operator neglecting to start the flux flow when necessary. Using the flux valve with its automatic operation, the operator knows when the electrode is in direct contact with the work since that is the only time when the flux would flow. Compact, the valve may be attached directly under the flux hopper. As a further advantage, it will not jam either in an open or closed position. It has been designed to operate with all the LAF-2 automatic welding heads. **T-7-1144**

—and how it can cut tap costs up to 75%!

Leading metalworkers find the B.P.S.* System reduces their tap costs by 50 to 75% — and more! And the same profitable plan is available to *you!*

B.P.S.* SYSTEM ALWAYS WORKS!

These two simple processes *cannot* fail: (1) Sharpening flutes and chamfers of taps to an exceptionally high degree of accuracy (possible only on Blake grinders) and (2) Sharpening your taps at *regular, planned* intervals.

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*Blake Precision Sharpening

HERE'S WHAT THE B.P.S.* SYSTEM CAN DO FOR YOU!

BLAKE CHAMFER GRINDER

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- Gives much more production per tap!
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Write us for reprints of *American Machinist* and *Machinery* articles on this subject. Descriptive folders on both Blake grinders also available.

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Tiny Universal Joint

A new miniature, lightweight universal joint has been added to the line of Rzeppa constant velocity joints, made by the Joint Div., The Gear Grinding Machine Co., 3901 Christopher, Detroit,

Mich. Like others in the line, it is compact, built for durability, provides uniform flow of power, is of minimum weight, and offers long life.

The two views illustrate the shaft's adjustable length feature. A lead pencil placed below the shafts permits size evaluation. **T-7-1151**

Milling Attachment

This high-speed, heavy-duty all-universal Brown vertical milling attachment offers a speed range to 4500 rpm and a gear rating capacity of 1½ to 15 hp. Its lapped-in, heat treated spiral bevel compound miter gears run silent in oil. For most makes and sizes of horizontal mill-

ing machines, boring mills and planer machines, the heads are available in 32 sizes and models.

The head may be mounted in two plane positions—the cone base type is bolted to the vertical column of the milling machine and operated with direct power take-off from the front main spindle drive; the over-arm spindle drive adapter type is mounted into the over-arm bore and operated with direct power drive take-off from the rear main spindle on the milling machine table.

Full details are available from the maker, Brown Vertical Milling Head Co., 1615 Riverside Dr., Los Angeles 31, Calif. **T-7-1152**

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Carb-O-Plating

has won favor throughout industry as one of the most efficient methods of imparting extra wear to the surfaces of gages, parts and tools.

This method employing the Linde Process applies a thin wear-resistant coating of tungsten carbide in wearing surfaces to extend the life of gages and hundreds of tools many times over.

Carb-O-Plating gives you wear life of carbide at a cost substantially lower than the use of solid material can give you. And because of the steel base, the products have resistance to mechanical shock and are not subject to breakage as can occur with sintered carbide. Carb-O-Plating also increases accuracy.

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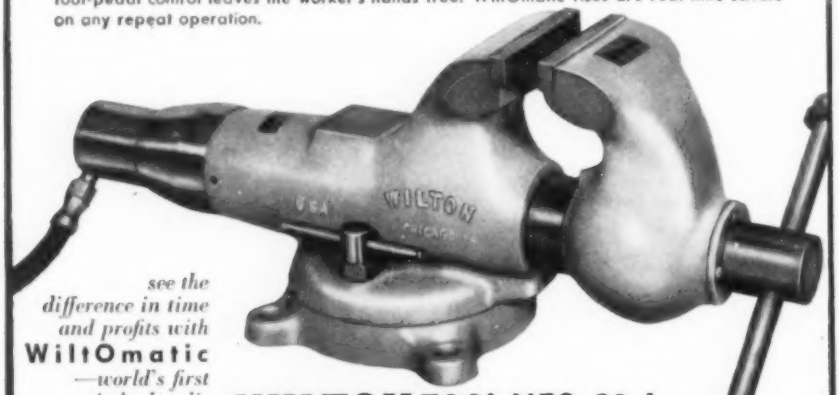

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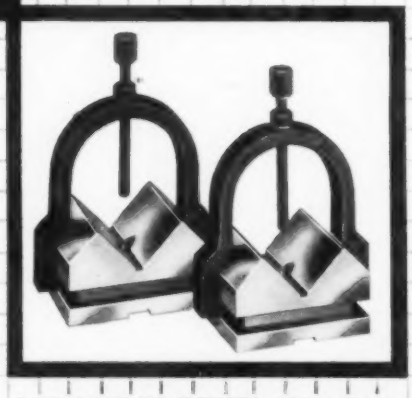
UNI-V-BLOCK by Precision Tool



Made of close grain, stabilized Chrome-Moly alloy to guarantee precision results every time. The exclusive new FROZONE process, for hardness and stability, makes *UNI-V-BLOCKS the closest thing to absolute perfection, on the market today!*

Shown here is MODEL No. 3000 (2 7/32 x 3¾ x 2 15/16")
UNI-V-BLOCKS are also available as:
MODEL 5000 (4 5/16 x 5⅛ x 5⅜")
MODEL 1250 (1¼ x 1¼ x 1⅝")

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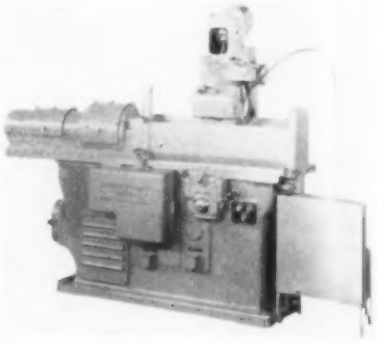
Improved Sharpener

Redesign of its No. 10-12 h[ra]ula sharpening machine now allo[ws] the Barber-Colman unit to accom[modate] wet grinding of high-speed st[eel] and carbide-tipped hobs and form-[relieved] cutters. Both wheel and work [spin-]



are protected against effects of coolant. Other improvements in the machine are greater rigidity of wheel spindles to promote finer surface finishing on flat faces; wheels are mounted on an adapter which fits onto the tapered wheel spindle, allowing diamond wheels to be trued satisfactorily on a tool grinder. Drive for the wheel motor, mounted parallel to the wheel spindle, is through a timing belt, avoiding slippage.

Bulletin 6216, available from the Barber-Colman Co., Rockford, Ill., provides complete details. **T-7-1161**

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Desk Model Lathe

A versatile desk model production lathe offers a desk high bed and spindle, plus an operating lever and pedals placed for fast and easy action.

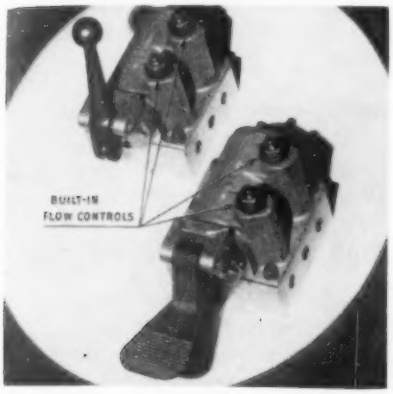
Features of instant spindle run-stop and collet position control make it an excellent machine for short turning, facing, crimping, and other operations.

It is made in two models: the 4P7,

a ¾-inch draw-in type collet, and ... 13/16-inch stationary type collet. It ... a 7-inch swing, 15 inches between ...ters, speeds to 4,000 rpm and may ... equipped with compound slide rest, ...ible cross slide, 6-hole turret and ...er standard bench lathe accessories. The unit is made by Elgin Tool ...rks, Inc., Dept. K, 1773 Berteau ...e., Chicago 13, Ill. **T-7-1171**

Four-Way Valve

A hand-and-foot operated 4-way ...alve that offers built-in full capacity flow control meters of the Venturi type has been designed by Airmatic Valve, Inc., 7317 Associate Ave., Cleveland 9, Ohio. Specifically, they are designed for the control of double acting air or hy-



draulic cylinders, and are available for air, oil or water in pressure range 0-150 pounds.

These components, which are built for heavy-duty and long operating life under heavy duty, feature one balanced spool using renewable O-ring type of packing. Flow control meters permit full-line volume without pressure loss, although line-pressure variation does not affect valve function.

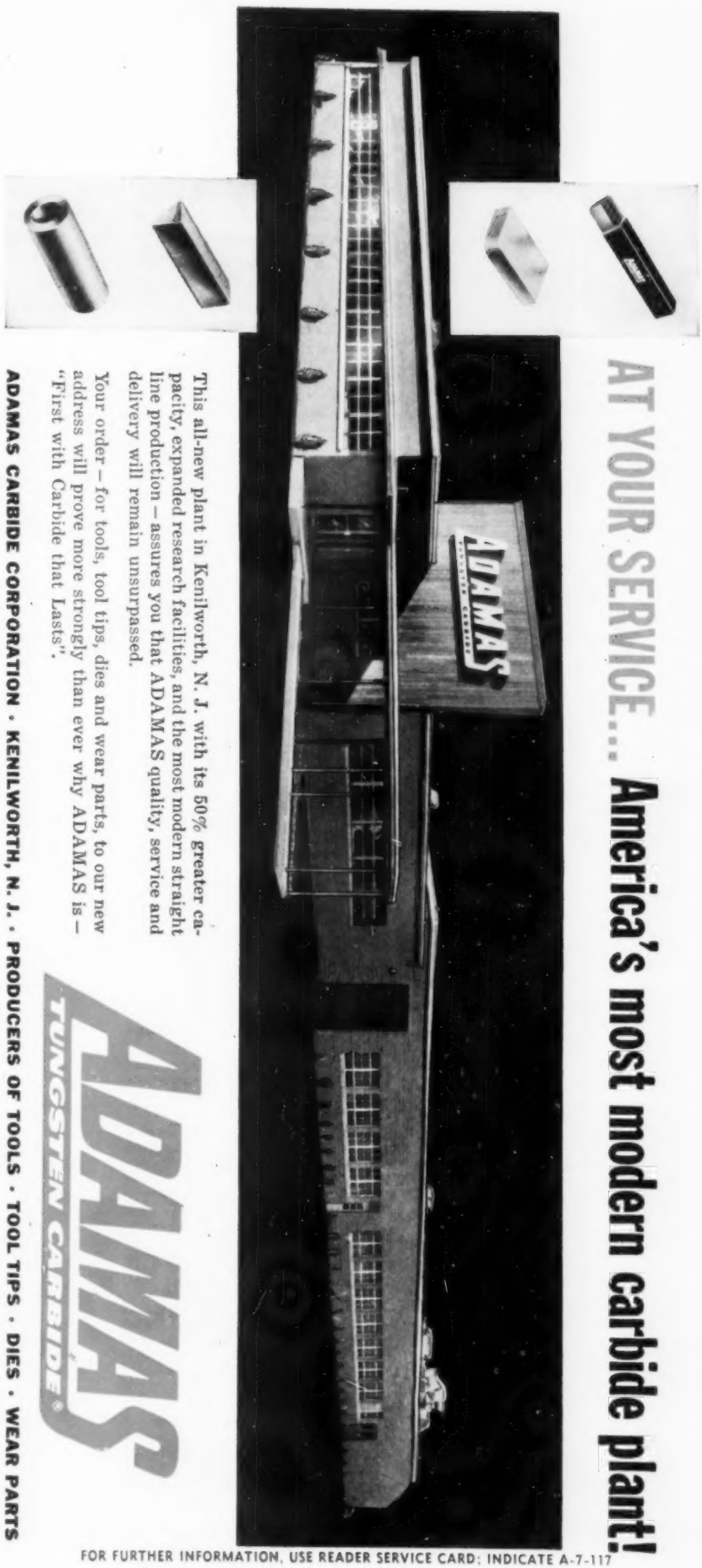
The basic valve, which is available in ¼, ⅜, ½ and ¾ inch standard pipe sizes, is also available for remote pilot operation, cam, single or double solenoid together with time-delay features. **T-7-1172**

Indexing Tables

The A. K. Allen Co., 57 Meserole Ave., Brooklyn 22, N. Y., has introduced its model 725-F indexing dial feed tables with positive lock feature similar to those on their larger models.

Designed particularly for use in areas with limited space, the tables have 7¼-inch diameter top plate and can be mounted either horizontally or vertically.

A prime feature is the availability of compressed air at the top center of the tables, so that air clamps, air collets, or air chucks can be operated from



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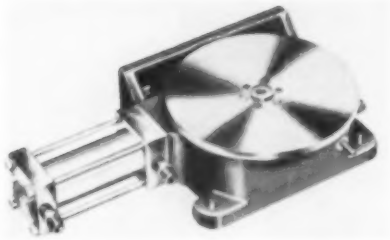
This all-new plant in Kenilworth, N. J. with its 50% greater capacity, expanded research facilities, and the most modern straight line production – assures you that ADAMAS quality, service and delivery will remain unsurpassed.

Your order – for tools, tool tips, dies and wear parts, to our new address will prove more strongly than ever why ADAMAS is – "First with Carbide that Lasts".

ADAMAS CARBIDE CORPORATION • KENILWORTH, N. J. • PRODUCERS OF TOOLS • TOOL TIPS • DIES • WEAR PARTS

ADAMAS TUNGSTEN CARBIDE®

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-7-117



an outside source as the tables are revolving.

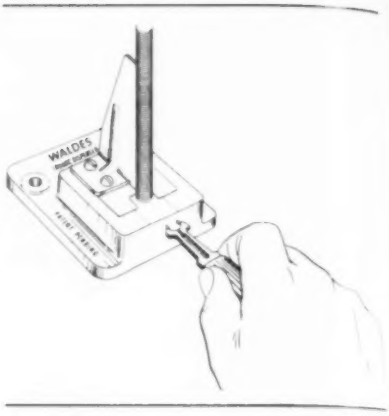
Model 725-FA is furnished without control valves, and Model 725-FB comes completely equipped for fully automatic operation.

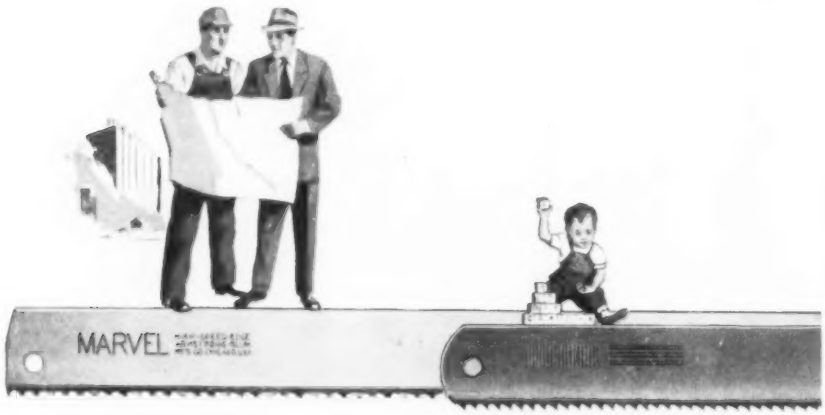
Both models are available in the standard 4, 6, 8, 12 and 24 set of indexing positions. Accuracy of indexing is guaranteed within ±.002 at the periphery of the top plate. **T-7-1181**

Retaining Ring Dispenser

A dispenser for their crescent and E-shaped retaining rings has been introduced by Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N.Y. Two major components make up the unit: a machined weighted base which may be secured to the top of a bench or assembly table, and a bracket assembly consisting of a bracket, shim plate and spring rail.

It offers several advantages. The minimum number of parts require no adjustment or maintenance. Dispensing operation is simple and may be used by unskilled labor. The same base may be used for most ring sizes with only the bracket assembly changed to accommodate different ring sizes. Rings extracted from the dispenser may be mounted rapidly with a minimum operator fatigue. Design permits the applicator to grasp the rings flush to the surface of the tool's underside, which also makes it possible to mount the rings without turning over the applicator. Since rings are grasped in this manner, an offset applicator can be used to install rings on shafts where obstructions ordinarily would handicap installation. **T-7-1182**





. . . but

Experience Cannot be Copied

More than a quarter-century ago MARVEL invented and basically patented the MARVEL High-Speed-Edge Hack Saw Blade—the UNBREAKABLE blade that increased hack sawing efficiency many-fold.

Every MARVEL Hack Saw Blade ever sold has been of that basic welded high-speed-edge construction, with constant improvements from year to year, as EXPERIENCE augmented the "know-how" . . .

MARVEL is not "tied" to any single source of steel supply, and has always used the best high speed steels that became available from time to time as metallurgy progressed. When-as-and-if finer steels are developed—and are proven commercially practical for welded-edge hack saw blades—MARVEL will use them, regardless of cost or source . . .

There is only one genuine MARVEL High-Speed-Edge! All other "composite" or "welded-edge" hack saw blades are merely flattering attempts to imitate—without the "know-how" of MARVEL EXPERIENCE . . .

Insist upon *genuine* MARVEL High-Speed-Edge when buying hack saw blades—and be SAFE, for you can depend upon MARVEL. They have been "tested", "pre-tested", and "re-tested" by thousands of users for more than a quarter-century!

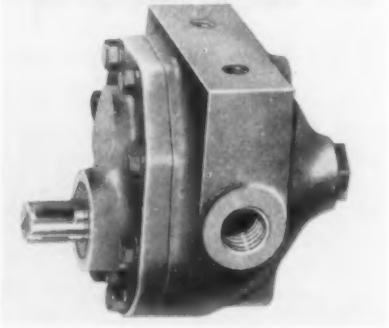
MARVEL Metal Cutting SAWS
Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 Bloomingdale Ave. • Chicago 39, U. S. A.
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-118

High-Pressure Gear Pump

Pesco Products Div., Borg-Warner Corp., 24700 N. Niles Rd., Bedford, O., announces a high-pressure pump for heavy-duty hydraulic power applications where minimum weight and bulk are desirable without sacrificing performance.

This Pesco Model No. 051002-110, incorporates developments of the pressure-loaded principle. Extensively tested, both in the laboratory and in the field, the pump has consistently exceeded anticipated performance.



Designed for pressures up to 2000 psi and capacity of 11 gpm (at 2400 rpm), the pump has volumetric efficiency up to 94 percent and mechanical efficiency up to 88 percent. It may be used for intermittent or continuous duty with oil temperatures to 150 F.
T-7-1183

Air Impact Hammer

An air impact hammer, designed by [illegible] Specialties Co., Dept. A T-74, [illegible] No. Knox Ave., Chicago 41, Ill., utilizes air pressure to replace the forward spring tensioned trigger mechanism to release the piston and accomplish the hammer blow. Because of the greater resistance that can be obtained in this way, force of the blow is naturally increased. Adjustment of the force of the hammer blow can be made while the tool is in action, permitting the operator to adjust the impact in accordance with the specific requirement at hand.

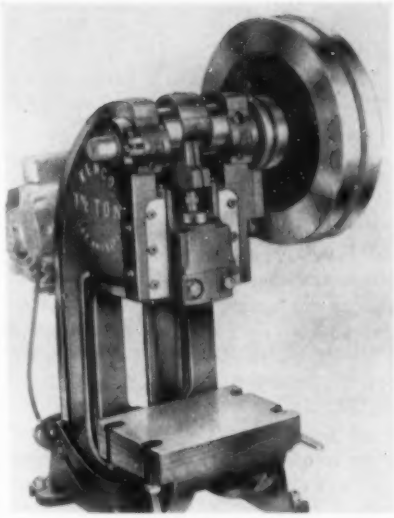
Need for mechanical parts replacement has been reduced if not entirely avoided. **T-7-1191**

Power Press

A 7½ ton power press precision built, has been added to the line of presses by Kenco Mfg. Co., 5211 Telegraph Rd., Los Angeles 22, Calif.

Strength, rigidity and durability are characteristic of the unit. The frame, constructed by the Sobrocast process to give 2½ times added strength to the castings, has a safety factor of five. The single trip is standard equipment and can be converted to continuous instantly by moving only one lever. It offers a 1½ inch standard stroke, but any stroke up to 3 inches is optional. The ram and ram guide are 90 deg., V-type, Sobrocast, oversize in length for added precision.

All parts of the open-backed in-



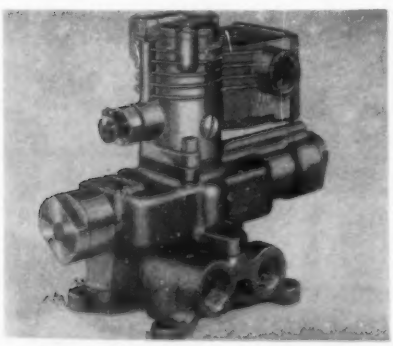
Tool Bits

Two lines of ground tool bits, high-speed and cobalt, are announced by Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill. Made of superior grades of steel and accurately ground on all four sides with ends bevelled 10 degrees, both types are available in a full range of twelve sizes from 3/16 to 1¼ inch square, and are packaged for convenient handling. **T-7-1192**

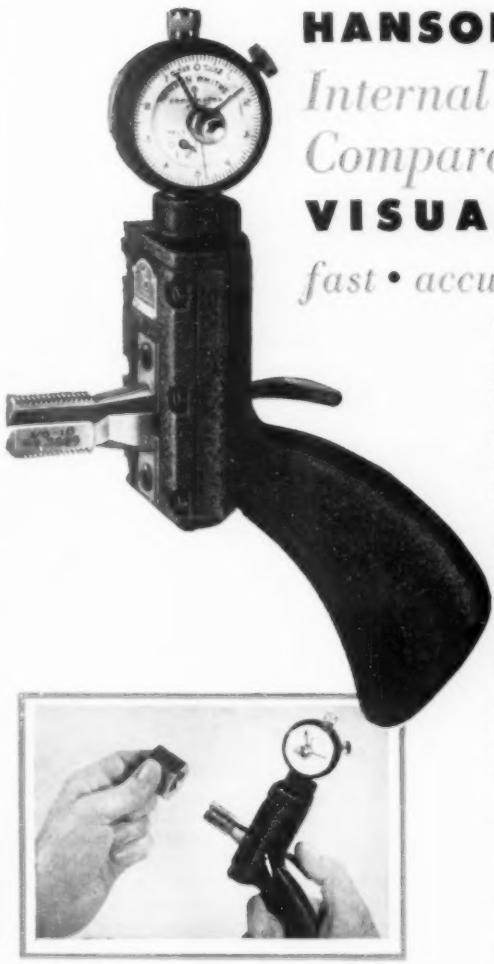
Control Valves

The Speed King line of solenoid pilot operated control valves announced by Valvair Corp., 979 Beardsley Ave., Akron 11, Ohio, are designed to meet JIC standards. Only moving parts are the stem in the base and plunger in the solenoid. All parts are totally enclosed and the junction box for electrical control is cast integral with the housing of the pilot control unit. The pilot, universal to all assemblies, may be mounted in two directions over the base.

The valves, which are available in 2, 3, 4 and 4-way-5-port (2-pressure) models with pipe sizes from ¼ through 1 inch, have a pressure range from 35 to 200 psi. **T-7-1193**



NOW... *a new addition to the famous* **HANSON** *processes*



HANSON-WHITNEY

Internal Thread Comparator for

VISUAL GAGING

fast • accurate • economical

This new Hanson-Whitney Internal Thread Comparator provides fast, accurate, economical, visual gaging of all forms and classes of internal threads in diameters ranging from ⅜" to 1½". Thread segments are quickly interchangeable for inspecting other types, sizes and forms of threads. Accumulated errors of lead and pitch diameter can be analyzed by using the H-W Comparator with special two-thread segments.

Recognized Hanson standards of quality are embodied in the new H-W Internal Thread Comparator. All movable parts are hardened, ground and lapped to precision tolerances—thread segments will outlast several plugs. Exclusive actuating principle insures long-life accuracy.

Your nearest Hanson-Whitney representative will gladly show you how to reduce your gaging costs with the new Hanson-Whitney Internal Thread Comparator.

HANSON-WHITNEY COMPANY
Division of Whitney Chain Company, Hartford 2, Connecticut, U. S. A.

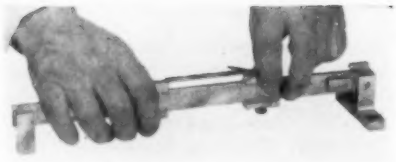
2322

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-119

clinable press are interchangeable and made extra heavy.

The standard press is a bench model, but it is also available with floor legs.

T-7-1201



Close Tolerance Gage

A bench type Center-Mike that measures center distances to 0.0005-inch tolerances—in a stated 10 seconds, regardless of hole sizes—has been introduced by Sorensen Center-Mikes, Inc., 264 Kossuth St., Bridgeport, Conn. Production gaging of small, flat or irregular metal components having center distances ranging from 0.040 to 12.4 inches, may be accomplished with this precision tool, which is ready for instant use on any combination of holes within range and affords a half-thousandth center-to-center direct reading. Diameters from 0.030 upward can be measured with the easily operated tool which produces uniform results regardless of operator.

In use, contacts are set against the closest points in two holes, then against the farthest points. This procedure "adds" the two dimensions between holes while the double size scale serves to divide by two to yield direct center distance reading. **T-7-1202**

SHELDON

CHICAGO U. S. A.

More will be *profit* with a SHELDON

It actually costs less to do turning jobs on a Sheldon Precision Lathe. Machine-tool investment is cut to a fraction. Power cost is materially reduced. Less experienced operators can operate Sheldons safely and efficiently. Even cost-loadings for plant—floor space, heat and light are lower because two Sheldons can often operate in the space occupied by one large lathe.

On most "everyday" jobs a Sheldon will actually turn out more pieces per hour too. With double V-belts to the spindle Sheldon lathes deliver enough power to take heavy cuts in direct drive, at high speeds. Sheldon's "Zero Precision" Taper Roller Bearings permit work to the closest tolerances. Seldom are such extremely accurate bearings used in moderate priced lathes.

You will actually keep more as profit if you see Sheldon Lathes.

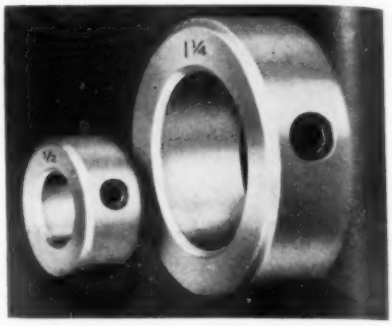
Write for Catalog

SHELDON MACHINE CO., Inc. 4229 North Knox Ave., Chicago 41, Illinois

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-120

Steel Collars

Rockwood Pulley Mfg. Co., Inc., 20 Crosby St., New York 13, N. Y., now offers a complete line of precision-machined solid steel and stainless steel shaft collars, cadmium plated with a zinc alloy to permit welding. All are equipped with hollow safety set-screws. Bore size is clearly stamped on the face. Collars are available from stock for immediate delivery in standard specifications with bore sizes from 1/8 to 3 inches in a total of 43 sizes, as well as special sizes made to order. **T-7-1203**



USE READER SERVICE CARD ON PAGE 135 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Surface Grinder

Hydraulic longitudinal action is now incorporated in the design of the 6 x 12 surface grinder made by Boyar-Schultz Corp., 2110 Walnut St., Chicago 12, Ill.

An hydraulic valve, designed by the company's engineers affords excellent reciprocating movement, and the machine can be changed from hydraulic to hand feed and return in a matter of seconds.

This addition makes the Boyar-Schultz unit the only surface grinder in this size to offer such a feature.

T-7-1204

Tool and Die Holder

This quick-stop reversible holder, the Cobb tap and die holder, has been specially designed for high speed production on any lathe by Cobb Precision Co., 1042 N. Cole, Hollywood, Calif.

Inserted in the tailstock of any lathe, it can be brought to an instant stop by the operator who simply releases his

hold on the tool. Only when the operator grips the shank or holder does the tap and die operate.

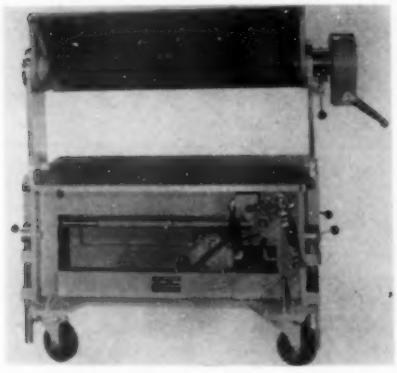
The maker reports that in some operations, the tool will complete tap and die work from 25 to 100 times faster without breakage or rejects and with excellent precision. Complete literature is available from the company.

T-7-1211

Die Handler

Hansford Manufacturing Corp., 1239 University Ave., Rochester 7, N. Y. has introduced a sturdy portable die-handling device that offers accurate service in a variety of uses.

It may be used either for taking a die apart for inspection, or to assist in safe efficient assembly of dies. The lower crank is used to raise the upper platen



which results in drawing the upper member from the lower. By turning an upper crank, the work may be revolved around the axis of the top platen.

A die handled by this unit permits work to be done in a variety of positions. A locking pin may be used to lock the upper platen in 0, 90, 180 or 270 deg angles.

A safety feature guards the operator since the motor control switch cannot be moved while the hand crank is engaged. **T-7-1212**

All these ½" diameter
HI-HELIX
END MILLS

Available FROM STOCK at STANDARD PRICES

TWO FLUTE

BALL NOSE TYPE — LIST NO. 360

REGULAR TYPE — LIST NO. 356

LONG (EXTENDED) TYPE — LIST NO. 3561

DOUBLE END TYPE — LIST NO. 357

FOUR FLUTE

REGULAR TYPE — LIST NO. 358

LONG TYPE — LIST NO. 3581

EXTRA LONG TYPE — LIST NO. 3582

DOUBLE END TYPE — LIST NO. 359

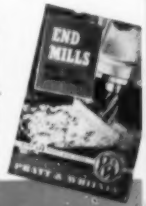
Four Flute Styles are available in Two End Tooth Designs

Cut-To-Center-Hole Type
Preferred for milling operations requiring radii on the end teeth.

Cupped Type
Preferred for all general milling operations.

FOR COMPLETE INFORMATION write on your Company letterhead for Circular No. 534.

PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U. S. A.



First Choice for Accuracy

BRANCH OFFICES AND STOCK . . . BIRMINGHAM* • BOSTON • CHICAGO
CINCINNATI • CLEVELAND • DALLAS (The Stanco Co.) • DETROIT • HOUSTON
(The Stanco Co.) • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH
ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., WEST HARTFORD

MACHINE TOOLS • CUTTING TOOLS • GAGES

*OFFICE ONLY

Listed below are some of the operations discussed in Oakite's 44-page handsomely illustrated booklet on Metal Cleaning. Please check the list. Then let us show you how Oakite methods can give you better production with greater economy.

Technical Service Representatives in Principal Cities of U. S. and Canada

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE

OAKITE PRODUCTS, INC.
58 Rector St., New York 6, N. Y.

Tell me about Oakite methods and materials for the following jobs:

- ☐ Tank cleaning
- ☐ Machine cleaning
- ☐ Electrocleaning
- ☐ Pickling, deoxidizing
- ☐ Pre-paint treatment
- ☐ Zinc phosphate coating
- ☐ Paint stripping
- ☐ Steam-detergent cleaning
- ☐ Barrel cleaning
- ☐ Burnishing
- ☐ Rust prevention
- ☐ ALSO send me a FREE copy of your booklet *"Some good things to know about Metal Cleaning".*

Name _____

Company _____

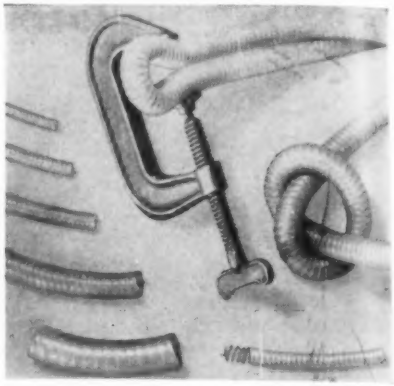
Address _____

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-122

Plastic Hose

An unusual type of piping has been made available by Newage International Inc., 235 E. 42nd St., New York, N. Y. The tubing is made of translucent plastic with 120-ton tensile helical steel wire imbedded in its walls, which makes it practically uncrushable.

Included among the tubing's advantages are complete flexibility—it will bend around a 5/16-in. diameter spindle without reducing its internal bore—and will remain flexible and withstand temperatures up to +70 C and as low as –40 C; chemically inert; is resistant to water, oil, grease, most acids, alkalis and gases.



The tubing, known as Armourvin, can be manufactured in one continuous piece in lengths up to 2 miles, in a variety of core diameters.

A variation of Armourvin, Armorflow, is designed to be especially resistant to gasoline and other highly volatile fluids, and can conduct boiling water without ill effect. It remains flexible at temperatures as low as –40 C, and will also react properly at temperatures up to 150 C. **T-7-1221**

USE READER SERVICE CARD ON PAGE 135 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Flow Control Air Valve

Rivett Lathe & Grinder, Inc., Boston, Mass., announces a valve to meter flow in one direction and allow free flow in the opposite direction.

Model 3620 Rivett valve features an anodized aluminum body and a nylon poppet. The corrosion-resistant adjusting screw has a slotted hex head which may be turned with a wrench or screwdriver. Tightening the hex nut on the opposite end of the adjustment screw locks the setting.

Recommended for 150 psi air or 300 psi oil or water, this 3/8-inch size valve has a 3-inch length x 1 1/8-inch hex, and weighs only 6 oz. **T-7-1222**

TRADE LITERATURE

For Free Booklets and Catalogs—
Convenient Request Card on Page 135

End Mills

Catalog 54-C covers company's complete line of end mills, router bits, countersinks, counterbores, corner rounding tools, live centers and special tools, outlining into special groups for easy reference; includes specifications, illustrations and prices. Melin Tool Co., Inc., 3372 W. 140th St., Cleveland 11, Ohio. **L-7-1**

Lubrication

Illustrated brochure tells how Spray-Lube system works to allow faster lubrication at less cost. Offers case histories to explain applications and resultant advantages. C. A. Norgren Co., 3400 S. Elati St., Englewood, Colo. **L-7-2**

Lathe

Leaflet shows new 13-inch geared head precision lathe describing special features, outlining specifications and listing various construction advantages. Sheldon Machine Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill. **L-7-3**

Profiling Unit

Informative illustrated folder shows many possible applications of Di-Profiler for profiling work; emphasizes exceptional speed and accuracy. Nord International Corp., 449 Central Ave., Orange, N. J. **L-7-4**

Hydraulic Components

Line of hydraulic components covered in 28-page condensed catalog 1101. Well illustrated, gives condensed descriptions and general specifications. Divided into four general sections: pumps, motors and power units; cylinders; valves; hydraulic circuit cylinders. The Hydraulic Press Mfg. Co., Lincoln Ave., Mount Gilead, Ohio. **L-7-5**

Die Finishing

Four-page illustrated Bulletin 103 deals with finishing forging dies by the wet blasting process. Explains both how work is done during manufacture of the dies and how it is done during reconditioning maintenance. American Wheelabrator & Equipment Corp., Mishawaka, Ind. **L-7-6**

Grinding

General catalog presents grinder information on portable electric grinder-millers, power quills, machine tool mounts and accessories for finishing work. Pictures each model with description and pertinent data. Precise Products Corp., 1328-30 Clark St., Racine, Wis. **L-7-7**

Trucks

Illustrated brochure discusses application of specially-designed industrial trucks for very unusual jobs or for further economies in ordinary truck handling. Includes case histories to demonstrate points. The Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland 3, Ohio. **L-7-8**

these hard facts tell WHY

A·B·C PIERCING PUNCHES
will serve you better!

PREMIUM QUALITY STEEL . . .
in two basic types: water hardening of guaranteed grain size and hardenability — and molybdenum high speed steel — both carefully heat treated in the most modern equipment available to capitalize fully on their high qualities.

HEAD AND SHANK DRAWN BACK . . .
to 45-50 Rockwell C for hardness gradient, giving "shock absorber" action to make for increased durability.

UNDERSIDE OF HEAD GROUND SLIGHTLY . . .
at same time as shank. This insures squareness with shank and minimizes breakage during stripping.

ASSURED DIMENSIONAL ACCURACY . . .
For example: point is ground concentric with body within .0005" total indicator reading.

FINE FINISH . . .
and smoothly blended radius to minimize stresses. These *extra* quality features are achieved by our special grinding fixtures and dressing equipment.

A·B·C Piercing Punches deliver the same ultra fine service that has won preference for A·B·C Drill Jig Bushings and A·B·C Precision Components for the aeronautical and related industries.

Write for catalog of A·B·C Piercing Punches. It includes information invaluable to men who buy or work with tools.

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5722 W. Chicago Ave., CHICAGO 51, Ill., ESterbrook 8-7180
Representatives in major industrial centers

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-123

Pumps

Bulletin DP-302 describes completely balanced PF-100 series Dual-Vane hydraulic pumps explaining principle of operation, construction features and listing performance data. Bulletin DP-308 covers PF-100 series double pumps with valve panels stressing economy and efficiency; outlines operation, advantages, construction features. Both well illustrated. Dudco Div., The New York Air Brake Co., 1700 E. Nine Mile Rd., Hazel Park, Mich. **L-7-9**

Chain Drives

Comprehensive 88-page book No. 2425, "Silent Chain Drives" not only presents operation, construction features and advantages of line but offers detailed information on selection, use, installation, lubrication procedures and maintenance; includes 16 pages listing pre-engineered stock drives for normal requirements giving complete specifications, plus a 22-page section outlining procedure for selecting these drives. Extensively illustrated. Also covers components and accessories and includes complete operational and technical data. Extensively illustrated. Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill. **L-7-10**

Balancing

Illustrated leaflets describe balancing machines, under-drive, single plane balancers, and balancing equipment for special purposes; explain construction features, operation and advantages of units. R. B. Annis Co., 1101 N. Delaware St., Indianapolis 2, Ind. **L-7-11**

Steel Castings

Thirty-two page brochure deals with process of steel casting manufacturing from design and engineering to final applications. Written in nontechnical language, it is easily understood, yet offers interesting specific information for the foundryman. Request on company letterhead directly from Lebanon Steel Foundry, 160 Lehman St., Lebanon, Pa.

Maintenance

Pocket-size manual "The ABC's on Maintenance of Air and Hydraulic Equipment" deals in cartoon style with right and wrong way to set up and service air and hydraulic equipment. Stresses some of major reasons for unsatisfactory performance and suggests some ways to avoid such conditions. Logansport Machine Co., Inc., Logansport, Ind. **L-7-12**

Roll Winder

"Now Constant Tension from Start to Finish in Winding Roll-Fed Material" discussed in 4-page folder explains operation of this unusual type Alquist winder emphasizing its simplicity, efficiency and flexibility; includes drawings and photos. Hobbs Manufacturing Co., 209 Salisbury St., Worcester 5, Mass. **L-7-13**

Drill Grinder

Folder presents company's precision drill grinder for small drills, describing its construction and use and emphasizing its ease of use and speed and demonstrating how it can be used by unskilled operators. Black Diamond Saw & Machine Works, 76 North Ave., Natick, Mass. **L-7-14**

Speed Controls

Wide selection of speed control units and indicators described in well illustrated brochure covering units with fractional to 87 hp with speed ratios from 2:1 through 16:1. Reeves Pulley Co., Columbus, Ind. **L-7-15**

520 CUTS

IN AN 8-HOUR DAY...

Angles, Bars, Channels and Beams

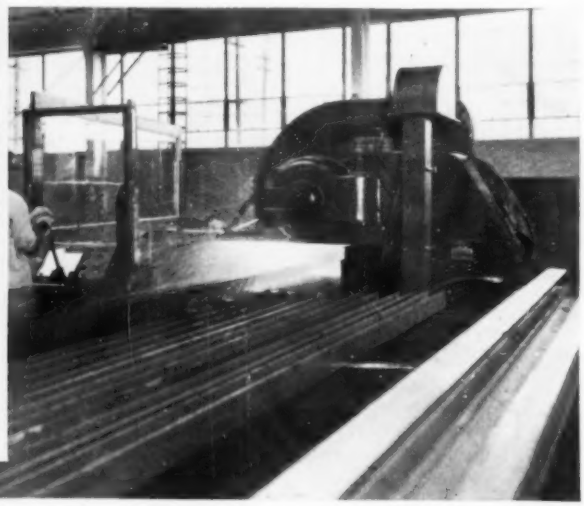
Report from Joseph T. Ryerson & Son, Inc., Chicago; branch warehouses in principal cities.

Number of Kling Friction Saws in use 16 — among all Ryerson plants.

Jobs performed Cutting angles, bars, channels, beams.

Average Cuts Per Day Average 520 cuts of miscellaneous items in an 8-hour day, ranging from light channel sections to 30" x 124 lb. beams.

Other Advantages Has reduced the amount of burr, reducing time required to chip or clean the cut.



Kling HIGH SPEED FRICTION SAWS

increase cutting production **FOR "THE BEST OF COMPANIES!"***

Greater cutting speed with all types of steel... versatile ability to cut many different kinds of structural shapes... cleaner cutting... and lower investment in initial equipment — these are some of the friction saw advantages that attract industrial plants and steel warehouses like Joseph T. Ryerson & Son, Inc.

One Kling High Speed Friction Saw can handle a volume of cutting that would otherwise require several shears or other type saws. Consequently, Kling Friction Saws make possible faster cutting of structural shapes without changing set-up, than any other known process.

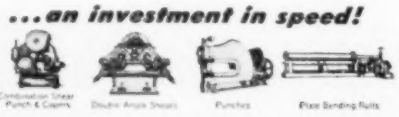
The reason for the exceptional speed of Kling Friction Saws is, that they operate on a principle practically the opposite of the ordinary tool or conventional saw. Friction sawing concentrates the heat on the material to be severed, at a rate which is faster than it can absorb heat. The process is not new, but has been applied successfully for years.

* Some of the companies using Kling Friction Saws:
Allis-Chalmers Mfg. Company · A. M. Castle & Company · Bethlehem Steel Inc. · Douglas Aircraft Co., Inc. · Kyle & Company · L. B. Foster Company · Lone Star Steel Company · Madson Iron Works Inc. · Jos. T. Ryerson & Son, Inc. · Stephens-Adamson Mfg. Company · The H. M. Harper Company · U. S. Steel Corporation

Complete Friction Sawing Information FREE! Write for Bulletins that tell you in detail, exactly how Friction Saws work and what they can do in your shop to save you time and money.

KLING BROS. ENGINEERING WORKS · 1320 North Kostner Avenue, Chicago 51, Illinois

Since 1892 **Kling** ...an investment in speed!



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-124

ckel Alloy Casting

Bulletin A-141, "Heat Resistant and rosion Resistant Alloy Castings in lustry," offers extensive information luding typical, regularly produced positions which their applications, itations and suitable types of serv- Charts compare creep strengths, rrosion resistance, oxidation at ele- ted temperatures. More than 175 hotos show how applications of typi- al alloys by industry. The Inter- ational Nickel Co., Inc., 67 Wall St., New York 5, N. Y. **L-7-16**

Drilling and Tapping

Brochure on automatic drilling and tapping unit is aimed at helping solve complicated drilling and tapping production problems; special page explains tapping with company's unit which permits work without tapping head or lead screws. Well illustrated with drawings, photos and work charts. Hypneumat Inc., 647 W. Virginia St., Milwaukee 4, Wis. **L-7-17**

Presses

Bulletin 46, "Recommendations for Modernization and Conversion of Straight Side and Gap Frame Double Crank Presses," includes 18 examples covering 42 conversion assemblies developed to revitalize presses. Well illustrated and easy to follow. E. W. Bliss Co., Canton, Ohio. **L-17-18**

Testing

Two universal testing machines of 20,000 and 60,000-lb capacity described and illustrated in 4-page folder 4213; discusses principles of their hydraulic straining system and the Tate-Emery null method load indicator; also describes accessories and specifications. Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa. **L-7-19**

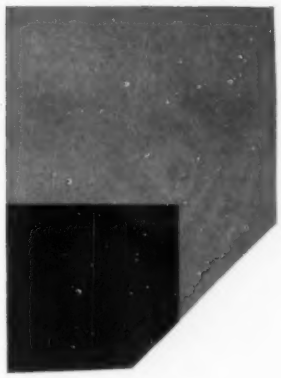
Filtration

Four-page folder reports a specific central filtration installation, showing typical machines served by it and the resultant advantages in economy, efficiency and extended tool and coolant life. Industrial Filtration Co., Dept. W-298, Lebanon, Ind. **L-7-20**

Weld Grinding

Illustrated 8-page booklet, "Weld Grinding and Blending with 3M Abrasives," offers information on using coated abrasives to reduce cost, increase production and improve finish. Includes recommendations for materials to use for various types of welds. Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul 8, Minn. **L-7-21**

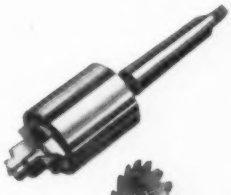
for Special Service on Carbide "Specials"

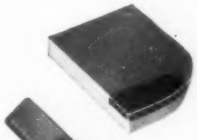


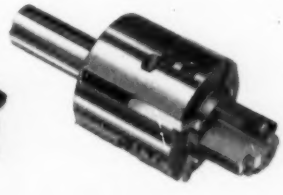
GORHAM

GORHAM

GORHAM







When your production machining problem dictates the use of special carbide tooling, your nearby Gorham Field Engineer can give you the right answers fast! He's an expert in the design and application of special cutting tools . . . and he provides a complete engineering service to determine your exact requirements.

He begins with your product, sketch or idea. He surveys your production operations and available equipment. He considers work material properties and required finishes and tolerances. He plots speeds, feeds and methods of tool driving. Then he develops practical design and metallurgical specifications for a special tool that's "tailor-made" for your application. And his recommendations are backed by Gorham's more than thirty years' experience in the design, manufacture and heat treatment of fine cutting tools.

Yes, your nearby Gorham Field Engineer is a helpful man to have around! If you haven't yet met him, write for his name, or send details of your problem direct, and we'll have him get in touch with you promptly.

Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

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WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-125

Men at Work . . .

Crucible Steel Co. of America has announced the election of **Joel Hunter** as president of the company. He succeeds **William H. Colvin** who wished to retire from active business life, although he will continue as a member of the company's executive committee and board of directors. Mr. Hunter joined Crucible in 1951 as vice-president in charge of finance, and later became executive vice-president and a director of the company.

Election of **James M. Mead** as a vice-president and director of Joseph T. Ryerson & Son, Inc., has been made public. After joining Ryerson at the beginning of his business career in 1919, he served in multiple capacities until two years ago when he was promoted to assistant vice-president with headquarters at Chicago. In his new capacity, Mr. Mead will be in charge of procurement for the company's group of 16 steel service plants.

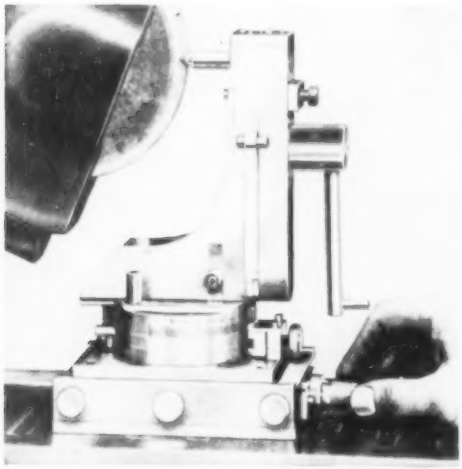
During recent elections at Hydropress, Inc., **Hugo Lorant**, vice-president and member of the board, was made senior vice-president; **Hermann A. Bottenhorn**, Rolling Mill chief engineer became vice-president in charge of the Rolling Mill Div.; **Paul Mayer** was named assistant vice-president of the company; and **Ernest E. Kugel**, director of Rolling Mill sales, was elected a member of the board of directors.

Richard M. Morgan, who has been a design engineer for Harris-Seybold-Potter Co., has now been placed in charge of production tooling, production engineering and plant layout at Miller Fluid Power Co. which he joined last March.

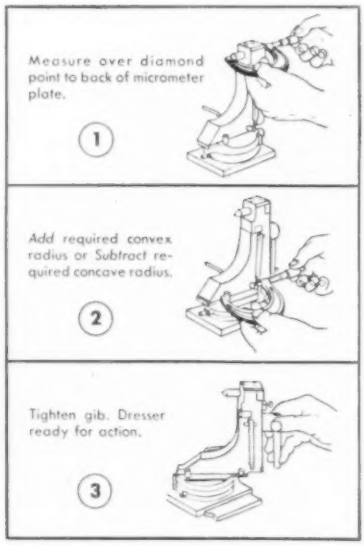
Paul B. Brown has been made a director of Abrasive and Metal Products Co., and at the same time was appointed to the positions of president and general manager of the Peninsular Grinding Wheel Div. and to the presidency of the Peninsular Grinding Wheel Sales Corp., a wholly owned subsidiary. Mr. Brown, who has been active in the grinding wheel industry for the past 28 years, joined Peninsular in 1953 as vice-president and general manager.

Donald C. Burnham has joined Westinghouse Electric Corp. as vice-president in charge of manufacturing. He previously was with General Motors Corp., where he held positions of manufacturing manager and assistant chief engineer of the Oldsmobile division. Considered an authority on industrial manufacturing techniques, Mr. Burnham succeeds T. I. Phillips who retires after 39 years of service.

Announcement has been made of the appointment of **R. C. Allen** as director of mechanical engineering and of **L. J. Linde** as director of electrical engineering of Allis Chalmers general machinery division. Mr. Allen has been consulting engineer in the office of the director of engineering since 1951. Mr. Linde was appointed assistant general manager and chief engineer of Allis-Chalmers Boston Works in 1951 after having been retained previously by contract as a consulting engineer.



YOU CAN DRESS WHEELS UP TO 24" IN DIAMETER WITH J & S "FLUIDMOTION" WHEEL DRESSERS. MODEL REC SHOWN HERE.


Measure over diamond point to back of micrometer plate.
1
Add required convex radius or Subtract required concave radius.
2
Tighten gib. Dresser ready for action.
3

How to set angles in seconds, radii in minutes—save hours

These easy instructions show you how you can with a J & S "Fluidmotion" Wheel Dresser

Dressing wheels with a J & S "Fluidmotion" Wheel Dresser is easier than you might think. All you need is a micrometer and simple hex wrench. With a little practice, you can set 2 angles in about 10 seconds, a radius in just 2-3 minutes. Here's how to go about it:

To Obtain One Angle

Adjust center line of grinding wheel to height of diamond. The swivel base of the dresser is graduated at 100° on each side of center. Loosen knurled knob and hold both pins which protrude from bottom rings. Then simply set desired angle, tighten the knurled knob, and you're ready for action.

To Obtain Two Angles

Loosen knurled knob and set the pin on the *bottom ring first* for one angle. Then move pin on the middle ring for the other angle. Tighten the knurled knob—that's all there is to it.

To Obtain a Convex Radius on Grinding Wheel

Measure master reading over diamond point to back of micrometer plate (drawing #1) . . . for example	2.531"
Add required convex radius (drawing #2)	+ .069"
Setting for micrometer pins	2.600"

To Obtain a Concave Radius on Grinding Wheel

Measure over diamond point to back of micrometer plate (drawing #1) . . . for example	2.900"
Subtract required concave radius (drawing #2)	−2.142"
Setting for micrometer pins	.758"

Tighten gib. Dresser now ready for action (drawing #3)

How much time and trouble can a J & S Wheel Dresser save you? Figure it up. Then write us for complete information.

J&S TOOL CO., INC.

WHEEL DRESSERS • JAW CLAMPS • PRECISION VISES • SINE BARS • DOWN-HOLDING DEVICES

543 W. MT. PLEASANT AVE., LIVINGSTON, NEW JERSEY

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Thomas B. Doe, Jr. has been made master mechanic for Vickers Inc. Previously manager of aircraft product sales, he now will be responsible for process engineering, tooling and allied activities for all Vickers products.

Harvey J. Finison is now director of engineering for National Pneumatic Co., Inc. and Holtzer-Cabot Divs. He was formerly an executive in research and development for Armour Research Foundation.

Vas Peickii is the new factory manager of the Los Angeles plant of Micromatic Hone Corp. He is a former partner of the M. E. Engineering Co., which equipment and good will was purchased by Micromatic.

Donald H. McCuaig is manager of application engineering for Worthington Corp.'s entire Air Conditioning and Refrigeration Div. He was manager of the division's central station equipment section.

Appointments made at Standard Pressed Steel Co. include the promotion of **William M. Kerrigan** to the position of supervisor of production control, expediting and stock moving planning, and the advancement of **Wiliam J. Park** to the post of manager of quality control. Mr. Kerrigan formerly was supervisor of planning and scheduling, while Mr. Park was quality control foreman.

Two newly established offices for the Pennsylvania Salt Mfg. Co. have been filled by the company's board of directors with the election of **William Alfred LaLande, Jr.**, and **Edward F. Beale** to vice-presidencies. Dr. LaLande will also continue as manager of research and development, while Mr. Beale will retain his responsibilities as treasurer.

According to an announcement from Brown & Sharpe Mfg. Co., **Frank A. Benoit, Jr.** has been named superintendent of its foundry and pattern shop, to succeed LeRoy M. Sherwin who retired. Mr. Benoit had been assistant superintendent of the foundry.

Officers elected for the 1954-55 year to head the American Gear Manufacturers Assn. included **Richard B. Holmes**, general manager of Link-Belt Co., president; **Marvin R. Anderson**, general manager of Michigan Tool Co. as vice president; and **Fred R. Eberhardt**, president of Eberhardt-Denver Co. as treasurer.

Members elected to serve on the executive committee were **LeRoy R. Brooks**, president of Tool Steel Gear & Pinion Co.; **John A. Sizer**, president of Industrial Gear Mfg. Co.; **T. F. Scannell**, general sales manager of The Falk Corp.; **Ralph E. Rawling**, president of Rawling Gear Works.

Mr. Anderson and Mr. Rawling also are members of ASTE, and are affiliated with Detroit and Worcester chapters respectively.

44% FASTER

NEW ROTOR D-4 GRINDER

pays for itself in one month

ASK FOR BULLETIN NO. 43

JOB: Grinding edges and holes of flame-cut tube hanger plates with 4" plug wheels.

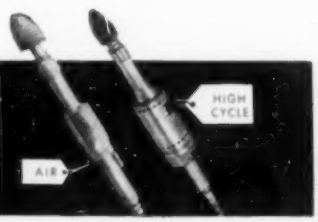
FORMERLY: Used 4500 rpm grinders. Output: 50 pieces per day.

NOW: Use new Rotor D-4 8500 rpm Grinders. Output: 72 pieces per day.

RESULTS: 44% more output paid off cost of new Rotor Grinders in one month. After that, it's pure savings.

Find out from your nearby Rotor Analyst how *you* can cut costs with the D-4 and other new Rotor portable tools! Ask for a demonstration.

THE ROTOR TOOL CO.
CLEVELAND, OHIO
UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS



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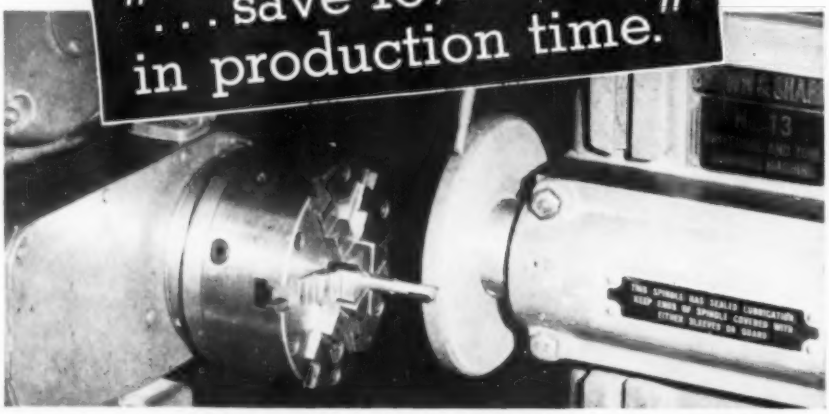
Daddy, you keep calling Superman "Superdie". (SUPERDIE® is Daddy's favorite die steel).

COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILL.

Producers of fine tool steels — All types immediately available through Sales Offices, Warehouses and Representatives in Principal Cities.

TOOL COLUMBIA STEELS

"... save 10% to 20% in production time."



Buck Chucks ideal for grinders

AJUST-TRU

PAT. NO. 2,629,157

CHUCKS

Only universal scroll chuck with .0005" precision — for lathes, grinders, dividing heads, screw machines.

3-jaw and 6-jaw in 4", 5", 6", 7½", 9" sizes. 3-jaw Aviation chucks, for odd-shaped parts, in 6", 7½", 9" sizes.

ALSO SUPER-GRIP 4-JAW INDEPENDENT CHUCKS FOR 9" to 16" LATHES.

Grinding the diameter and face of a centerless carbide tipped end mill — within plus .0000", minus .0005" — on a 5" Buck chuck is shown at the Brubaker Tool Corp., Millersburg, Pa.

THEIR REPORT: *"The chucking of various diameters to close tolerance is expedited with the Buck Ajust-Tru chuck. By limiting the indicator truing and chucking necessary with the old line chucks, we save 10% to 20% in production time."*

You save *every* time you use a Buck — for dead true work, on duplicate parts chucking at scroll chuck speed (.0005" precision guaranteed), by eliminating costs of collets and special holding fixtures. No price premium. Send for latest catalog today.

BUCK TOOL COMPANY

733 SCHIPPERS LANE • KALAMAZOO, MICH.

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Who's Meeting - and Where

July 12-15. AMERICAN ELECTROPLATERS' SOCIETY. Annual meeting, Statler Hotel, New York, N. Y. Complete data is available from society headquarters, 445 Broad St., Newark 2, N. J.

July 13-15. WESTERN PLANT MAINTENANCE SHOW. To be held concurrently with Plant Maintenance Conference, Pan Pacific Auditorium, Los Angeles, Calif. Direct inquiries to Clapp and Poliak, Inc., 759 Monadnock Bldg., San Francisco 5, Calif.

Aug. 3-4. PACKAGING MACHINERY MANUFACTURERS INSTITUTE. Semi-annual meeting, Dennis Hotel, Atlantic City, N. J. Write for more information to Institute office, 342 Madison Ave., New York 17, N. Y.

Aug. 16-18. SOCIETY OF AUTOMOTIVE ENGINEERS, INC. West Coast meeting, Statler Hotel, Los Angeles, Calif. Write to society office, 29 W. 39th St., New York 18, N. Y., for details.

Aug. 23-Sept. 3. MASSACHUSETTS INSTITUTE OF TECHNOLOGY. Intensive course on Casting of Light Metals; covering metallurgy, heat treatment, welding, behavior and control of gases in metals and other pertinent points.

Second course, on Automatic Control of Machine Tools, to be held during the same period, will cover systems and components, programming techniques, practical procedures and machine aids. For details and application blanks for either course, write Summer Session Office, Room 7-103, M.I.T., Cambridge 39, Mass.

Sept. 1-16. INTERNATIONAL ELECTROTECHNICAL COMMISSION. Golden Jubilee Meeting, University of Pennsylvania, Philadelphia. Direct correspondence to U. S. National Committee, American Standards Assn., 70 E. 45th St., New York 17, N. Y.

Sept. 5-8. PRESSED METAL INSTITUTE. Annual fall meeting, Manoir Richelieu Hotel, Murray Bay, Quebec, Canada. Direct inquiries to Institute offices, 2860 E. 130th St., Cleveland, Ohio.

t. 8-10. American Society of Mechanical Engineers. Fall meeting. Hoschroeder, Milwaukee, Wis. Contact ety office, 29 W. 39th St., New York N. Y. for particulars.

pt. 8-10. Porcelain Enamel Institute, Inc. Forum on shop practice, University of Illinois, Urbana, Ill. For details, write Institute office, DuPont Circle Bldg., Washington 6, D. C.

Sept. 12-16. American Institute of Chemical Engineers. National meeting, Colorado Hotel, Glenwood Springs, Colo. Get more information from Institute headquarters, 120 E. 41st St., New York, N. Y.

Sept. 12-17. American Chemical Society. Fall meeting, New York. For details contact society office, 1155 16th St., N. W., Washington 6, D. C.

Sept. 13-24. American Society of Mechanical Engineers. Joint IRD and ISA conference, Convention Hall, Philadelphia, Pa. Write to society headquarters, 29 W. 39th St., New York, N. Y. for more facts.

Sept. 13-24. Instrument Society of America. First International Instrument Congress and Exposition, Convention Hall and Commercial Museum, Philadelphia, Pa. More details are available from society office, 1318 Allegheny Ave., Pittsburgh, Pa.

Sept. 14-23. Fourth European Machine Tool Exhibition, Milan, Italy. For all details concerning the show, write to Dr. Ing. Enrico Brivio, general commissioner, Unione Contruttori Italiani Machine Utensili, Via Gaetano Giardino, 4, Milan, Italy.

Sept. 15-18. National Metal Trades Association. Plant management conferences, Sagamore Hotel, Bolton Landing, Lake George, N. Y. Association office, 122 S. Michigan Ave., Chicago 3, Ill., can supply more information.

Sept. 15-22. Society for Experimental Stress Analysis. Annual meeting, and joint session with first International Instrument Congress & Exposition, Bellevue-Stratford Hotel, Philadelphia, Pa. Get complete information from society—P. O. Box 168, Cambridge 39, Mass.

Sept. 22. Cutting Tool Manufacturers Association. Fall meeting, Lochmoor Club, Detroit, Mich. Write association office, 416 Penobscot Bldg., Detroit 26, Mich., for more facts.

10 cutting edges on one KENDEX* tool!

No tool grinding expense and *minimum* machine down time for tool changing—these are the advantages you obtain from multiple-edge Kendex "throw-away" insert tools. For example:

A Kendex round insert, used to bore 2½" cast iron stators, machined 300 pieces before one cutting edge dulled. Then, without removing the shank from the boring bar, the "button" was revolved to a new cutting position, until 3,000 stators were machined with the insert's 10 cutting edges. Best previous performance, by a conventional brazed tool, was 400 stators per tool grind.

Kendex precision-ground buttons have Kennametal's high wear-resistance, for long life. Screw-mounted, they can be rotated in seconds to new cutting positions without removing or resetting the tool holder . . . a great time-saving feature. When all cutting edges are used, the insert is thrown away—replacement cost is slight compared to that of regrinding.

Only Kennametal makes Kendex "throw-away" inserts. Ask your nearest Kennametal tool representative to help you apply this cost-saving tooling to suitable operations in your plant. Kennametal Inc., Latrobe, Pa.

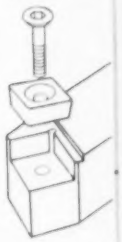
*Registered Trade-Marks

How KENDEX* Works

1

Hard, strong, wear-resistant Kennametal is molded into square, round, or triangular Kendex inserts, which are precision ground.

2



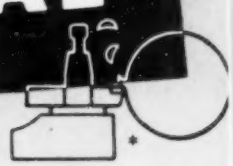
Kendex inserts are mounted to suitable tool holders with socket head screws.

3

When edge becomes dull, insert is turned to new cutting position. When all cutting edges have been used, insert is thrown away; no regrinding.

KENNAMETAL*

CEMENTED CARBIDE TOOLING THAT INCREASES PRODUCTIVITY



A-8

SALES OFFICES IN PRINCIPAL CITIES

How Flame-Plating keeps **DOWN-TIME** Down

Deep grooves worn in straightening rollers by small diameter wires often badly score larger wires which are passed through the same set-up. The result—costly machine down-time periods are necessary to change rollers. One manufacturer solved this problem by using rollers Flame-Plated with wear-resistant tungsten carbide. Now, machine down-time costs are at a minimum and a better product is produced.

Flame-Plating is a new LINDE process for applying wear-resistant coatings of tungsten carbide to the wear surfaces of parts and many tools made of most common metals. For the full story on how you can solve your wear problems with Flame-Plating, read the new "Flame-Plating" booklet.

CLIP COUPON TODAY FOR YOUR FREE COPY

LINDE AIR PRODUCTS COMPANY, Room 308 G-1
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.

Please send me your free booklet on Flame-Plating, Form 8065

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City.....State.....

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good reading

FORMULAS FOR STRESS AND STRAIN *by Raymond J. Roark. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $7.50, 381 pp.*

This book is a third edition prepared as a working handbook for engineers concerned with machine and structural design. It can also be used as an auxiliary textbook for courses in stress analysis and elasticity. Experimental data and empirical formulas have been revised to adapt them to the latest available information.

Also included is new material on sheer lag, stress and deflection of circular arches, flat plates with large deflection, pressure vessels and shells and stress concentration.

FREEDOM FROM INSECURITY *by Hugo E. Czerwonky. Published by Public Affairs Press, 2153 Florida Ave., Washington, D. C.*

Presented in this book is a new labor policy which guards the well-being of all workers and assures the preservation of the free enterprise system.

Alyso included is a discussion of the steps necessary to prevent future general business declines and an analysis of economic requirements for obtaining world peace.

The subjects of international trade and its enlargement, taxation, old-age security, unemployment insurance, corporate financing in the farm problem are also analyzed.

STATICS AND STRENGTH OF MATERIAL *by Roland H. Trathen. 440 Fourth Ave., New York 16, N. Y. Price $7.50, 506 pp.*

Principles of statics and strength of materials and the general methods of applying them to engineering problems are presented in this book. Two of its objectives are to correlate previous experiences in mathematics and physics with mechanics, and to develop an appreciation of mechanics as a science.

Extensive use is made of the free body concept. Care is taken in explaining sign conversions, and nomenclature conforms to American Standards Association standards.

THEORY AND DESIGN OF STEAM AND GAS TURBINES *by John F. Lee. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. Price $9.00. 502 pp.*

This book treats fundamentally steam and gas turbines. A modern theory of turbine flow passage design is presented in a manner understandable to mechanical engineers who may not have a background in aerodynamics or gas dynamics. The theory common to all comprehensible fluid machinery is treated, with extension and application of the theory of steam and gas turbines, axial flow compressions, and centrifugal compressors. Steam and gas turbine power cycles are discussed both from the ideal and non-ideal standpoint.

METALS ENGINEERING DESIGN. *Edited by Oscar J. Horger. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. Price $10.00. 405 pp.*

One of four volumes by the ASME, this handbook contains reference data on the design function in metals engineering. Consideration is given to material selection, design procedure, strength of properties and processing operations for good design.

Forty-eight sections contain discussions by authorities on such subjects as Fatigue Characteristics, Wear Consideration, Impact, Corrosion, Non-Destructive Testing, Elasticity, and The Theory of Failures.

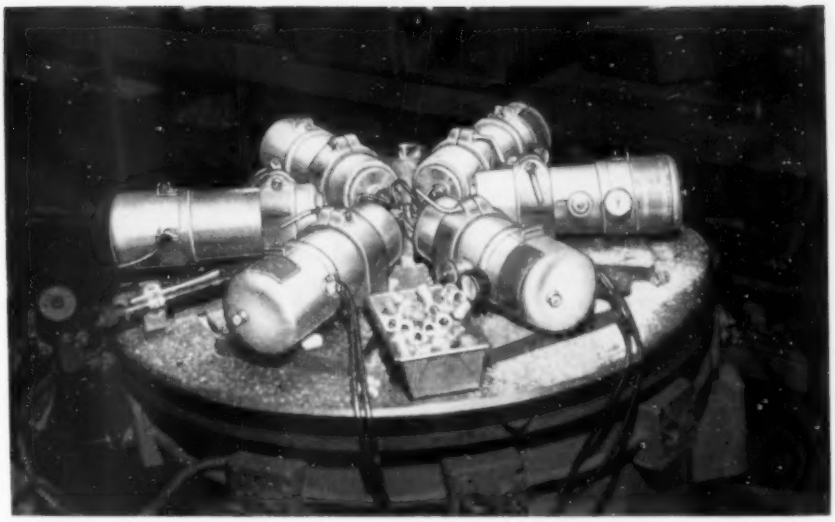
CIRCULAR AND DIAMETRAL PITCH OF KNURLING. *Reid Rolled Thread Die Co., Worcester 1, Mass. Price 75-cents. 21 pp.*

This booklet has been prepared to provide a source of condensed technical information on knurling for design and tool engineers. It presents general information about the process and its use, and briefly explains the circular and diametral pitch of systems of knurling.

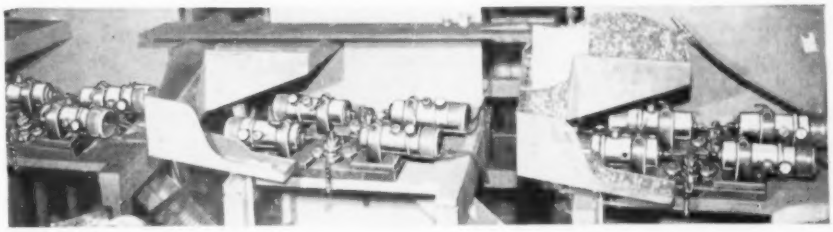
ROLLING MILLS, ROLLS AND ROLL MAKING. *Published by Mackintosh-Hemphill Co., 901 Bingham St., Pittsburgh, Pa. Price $5.00. 108 pp.*

While emphasis is on modern roll manufacture, this book traces early efforts to form metals. It presents a brief historical account of the development of roll making, rolls and roll mills from the fifteenth century to the present.

The book is particularly significant for its thorough descriptions of modern roll technology. Production of cast iron and cast steel rolls, from furnace to shipping, is discussed in detail.



Tooling simplified...output up...drill costs down



...with exceptionally versatile Dumore Automatic Drill Heads

HERE'S the story of another successful investment in Dumore Precision Tools. To mass-produce a variety of small holes in connector plugs, Cannon Electric Mfg. Co. of Los Angeles bought 16 Automatic Drill Heads.

Today, these Drill Heads are being used in multiple-head setups of four, six or eight heads per unit.

How efficient are they?

In one six-head, radially-mounted setup, production was upped 100%. On another job where all 16 heads were set up in four-head units, production was tripled. Speaking of the Dumores, Cannon's chief production engineer says, "We're very pleased. They've increased production, cut drill breakage and simplified our tooling."

About the pictures above:

Top Photo —

PRODUCTION UP 100%

This operation involves drilling 0.1285" through holes to a maximum of 3/16" in die-cast aluminum connector plug. Previous production, 200 pieces per hour — with Dumore's it's up to 600. Note simplicity of setup due to fact Dumores need no outside air or hydraulic supply, merely plug in electric outlet. When production requires, two more Dumores are quickly, easily added to setup.

Bottom Photo —

OUTPUT TRIPLED

Here are the Cannon Electric Mfg. Co.'s Dumores mounted in setups of four heads each. They're producing No. 49 and No. 18 holes to a depth of 3/16". In an hour, the Dumores complete 750 of the die-cast aluminum alloy parts compared to 250 previously.

If you're interested in obtaining similar all-around production, cost and tooling benefits—get in touch with your Industrial Distributor or write:

DUMORE PRECISION TOOLS

The Dumore Company

1325 Seventeenth Street • Racine, Wisconsin

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-131

Field Notes . . .

The zinc industry is anticipating an appreciable increase of zinc alloy die castings by industry due to a trend in 1954 toward cutting product costs according to Marshall L. Havey, president of the American Zinc Institute. Primarily, die casting will be more and more used since parts can be produced extremely accurately in almost limitless shapes with a minimum of machine operations. In this use, zinc-base alloys offer an excellent material because of high strength, ease of finishing and increased availability.

As an indication of the climb this metal has made in industrial popularity Mr. Havey pointed to production figures: In 1953 about 296,000 tons of zinc went into die castings as compared to the 13,000 tons of zinc consumed by industry in 1925.

V V V

Advances it has made in the use of ultrasonic energy for precision cleaning of metal are being explained by Detrex Corp. to industry through portable laboratory demonstration units now traveling through the country on an indefinite itinerary. Thus the special team of demonstrators may show ultrasonics in action before technical societies, in the plants of individual companies or at centralized hotel or exhibition areas where many company representatives may witness the work.

engineering classes

The Institute for Advanced Engineering has been established by the University of Texas, thus providing a place where practicing engineers may go to be brought abreast of new advances in science and engineering that have taken place since their formal schooling days.

The Institute, which is the first of its kind in the Southwest, is to be conducted by the University's College of Engineering in cooperation with the Division of Extension. After its first session, being held this summer, the Institute will offer courses in various fields throughout the year when proper arrangements can be made and when the demand justifies offering them, according to Dean W. R. Woolrich of the College of Engineering.

Classes, including laboratory work will be held at the University's Austin campus.

V V V

Intensive courses on engineering have been scheduled at University of Michigan's College of Engineering this August. Study of "Applied Machinability" will be undertaken Aug. 2 through 13; and from Aug. 9 to 20 "Cast Metals in Engineering Design" will be considered. The former course will cover fundamentals, theory, interpretation and application of machinability information. The latter, which will be divided into two-week sessions, will be concerned with properties of cast metals the first week, and with

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HAND SCREW MACHINES

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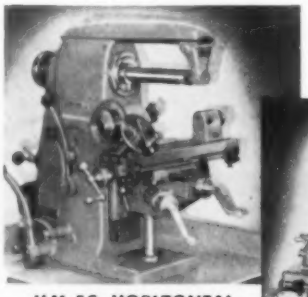
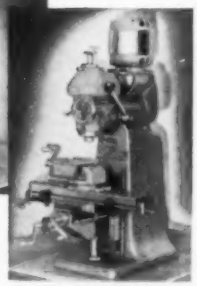
Back of the watch is the fine and accurate machinery, designed for the manufacture of its delicate parts, and if there is a wonder in watch-making, it begins there.

E P L-5C PRECISION TOOL ROOM LATHE
- 1" Collet Capacity.
- 9" Swing; 17" between centers.
- 120-3780 R. P. M., Continuously Variable.
- ¾, ⅜ H. P.

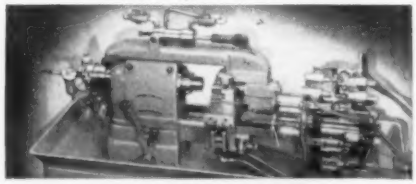


HM-5C HORIZONTAL MILLING MACHINE
- 85-2750 R. P. M. Continuously Variable
- Table; 4⅛ x 18"
- Travel; Longitudinal 12" Transverse 6" Vertical 9"
- 1" Collet Capacity



VM-2 VERTICAL MILLING MACHINE
- 200, 700, 1250, 2250, 4000 R. P. M.
- Vertical Spindle Travel 1¾".
- 9/16" Collet Capacity.

ET-5C HAND SCREW MACHINE
- 1" Collet Capacity.
- 9" Swing; 17" between centers.
- Equipped with Turret, Cross Slide, Coolant Pump and Sump, Automatic Collet Closer and Variable Speed Drive.



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- For High Production turning and facing operations.
- Hydraulic Power Feeds.

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...cations of cast metals, the second. ...though the courses are designed ...arily for graduate engineers, it is ...e conducted so that it will be of ...fit and interest to self-taught prac...g engineers.

Tool-rental plans

Manufacturers, always alert to their capital investment problems, may be interested in the Rental-Purchase Plan which has been drawn up by Induction Heating Corp.

The plan affords two varying alternatives which take into consideration the particular requirements and preferences of the company. The Ther-Monic Rental-Purchase Plan permits the customer to obtain equipment on a continuous rental arrangement, or to obtain the equipment for rental with option rights to purchase at any time after installation. A brochure giving all details, including cost schedules, is available from the company, 181 Wythe Ave., Brooklyn, N.Y.

V V V

Machine tool leasing through a special machine tool rental plan is possible with the arrangement introduced by The Gisholt Machine Co., designed to aid plants concerned with maintaining modern equipped shops but who for various reasons wish to keep their capital free. Three plans are available, each based on a seven-year lease agreement, and each may be written with or without the option to purchase. Right to terminate the agreement at the end of one, two or three years depends on the plan selected. In addition, the lease may also be written with the option to purchase at the end of any of those periods.

moves

Worthington Corp. has moved its entire reciprocating power pump operation handled formerly at the Harrison Works, to its Oil City plant. Factors affecting the decision were the greater space available at Oil City plus the technical experience and ability of that plant's personnel in manufacture of reciprocating power pumps.

V V V

A new home office and factory for Atlas Chain & Manufacturing Co. has been opened at 288 N. Main St., Doylestown, Pa. The move is part of a plan to

Photos courtesy Ford Motor Company Detroit Macoid Company.

DE·STA·CO HELPS PUT SKYLIGHT IN THIS CAR

Eleven Model 210 TU De·Sta·Co Toggle Clamps position and hold hot plastic sheets during the vacuum molding process used to produce transparent car roofs for Ford and Mercury automobiles. This fixture requires positive holding pressures during the 10 minute draw of Plexiglass sheet heated to 300° F. Two-second engagement and release of the De·Sta·Co Toggle Clamps speeds production, assures accuracy.

De·Sta·Co Toggle Clamps are available in over 45 models, with positive holding pressures up to 4000 pounds, for any work holding application.

Write for free catalog today.

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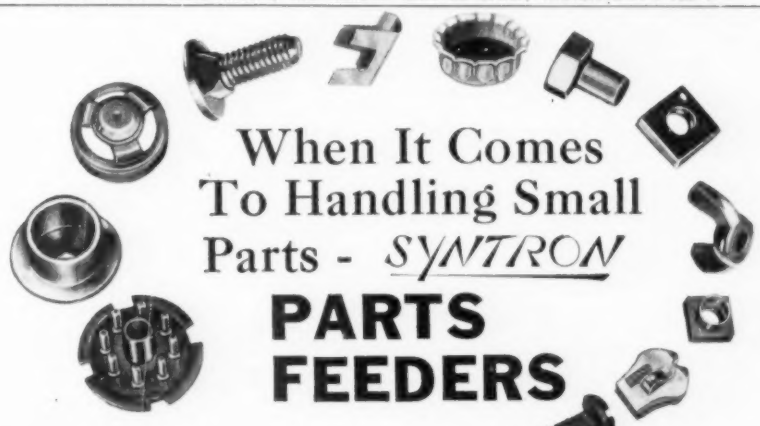

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New plastic demonstrators show the advantages of Horton's Famous Five Extras.

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3. Exclusive replaceable pinion bushings
4. Self-contained operating screws
5. One-piece body construction

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Windsor Locks, Conn.

INDICATE A-7-134

increase and centralize production facilities, while gaining space for future expansion. Within the next year Atlas is scheduled to make still other additions to house production and laboratory facilities now located at Ontario St., Philadelphia.

expansions

Opening of its recently completed 44,000 sq ft plant in Simsbury, Conn., has been announced by The Hartford Special Machinery Co. This is the first step in a plan designed to ultimately move the company's entire operation to Simsbury. At the moment, the new facility will be used as an assembly plant although fabrication of parts and the main offices will continue at the present Hartford location.

V V V

Ground has been broken for the multi-million-dollar metals plant at Blairsville, Pa., for Westinghouse Electric Corp. Anticipated completion date for the main building is the end of the year, with machinery and equipment to be installed and operating by mid-1955. The new plant is expected to bridge the gap between research and commercial application of new metals and alloys in the electrical industry. In this connection, the Blairsville unit will work with the new Westinghouse Research Center near Pittsburgh. It will provide equipment for the basic metal working processes of melting, forging, hot-rolling, cold-rolling, conditioning, pickling and heat-treating. In addition it will have facilities for new foundry techniques and will be equipped for limited manufacture of powder metal parts.

V V V

Construction has been completed and pilot operations are now under way at the Goshen Rubber Co., Inc.'s new plant at Goshen, Ind. The plant is scheduled for fabricating precision molded silicone parts. The latest facilities and departments, including presses, mills, extruders, curing ovens and trimming equipment will be housed here.

V V V

Opening of a Philadelphia sales office in the Western Saving Fund Bldg., Broad and Chestnut Sts. has been announced by American Nickeloid Co., makers of pre-plated metals. At the same time, closing of the Detroit sales office was announced. The company's former representative in Detroit, Mac F. Hermann, is not in charge of the new office.

V V V

A new district sales office for Superior Steel Corp., has been opened at Buffalo at 1212 Rand Bldg. Thomas C. Collins is the district manager who from this office will cover upper western New York state and the Toronto-Hamilton, Canada, areas.

new firms

Organization of a new steel company, the Economy Steel Service Co., has been completed by Jack Spear, formerly of the metallurgical department of Weirton Steel Co. The firm, located at 1832 W. Irving Park Blvd., Chicago, Ill., will specialize in sale and precision processing of sheet mill and precision strip mill coiled steel.

V V V

Representation of industrial manufacturers on an international basis will be the purpose of the recently organized E. V. Nielsen, Inc. The firm is located at 128 Broad St., Stamford, Conn.

broadened services

Knapp Mills, Inc. has revealed plans to broaden the company's operations by producing large scale chemical and process equipment from rigid unplasticized polyvinyl chloride in addition to its present production efforts. The step is an outgrowth of experience during the past year when Knapp undertook a foreign licensing program which resulted in exchange of American patents and skill for latest developments in the chemical equipment field in Germany, France and Italy. Study indicated that permanently successful applications appeared to have resulted when the material used was unplasticized polyvinyl chloride.

V V V

Entry into the thermostat metal field has been announced by American Silver Co., Inc. Heading the Thermostat Metal Div. is Stanley R. Hood, who is credited with several developments for bimetal application. The step is in keeping with the company's program of diversification aimed at broadening ultimate markets.

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-7-123	Accurate Bushing Co.	**Piercing Punches**—Catalog of A.B.C. piercing punches includes information to men who buy or work with tools. (Page 123)
A-7-194	Allied Products Corp.	**Pierce Punches**—Catalog "Punches and Dies" discusses Richard Brothers' punches and dies. (Page 194)
A-7-177	American Broach & Machine Co.	**Broaches**—Catalog 450 describes American broaches, machines and fixtures. (Page 177)
A-7-13	American Drill Bushing Co.	**Drill Bushings**—New catalogs aid in size selection and features of American drill bushings. (Page 13)
A-7-12	The American Tool Works Co.	**Lathes**—Bulletin No. 44 describes and discusses the American Pacemaker Lathe. (Page 12)
A-7-144	B. C. Ames Co.	**Small Hole Gage**—Catalog completely describes Ames precision measuring instruments. (Page 144)
A-7-220-3	Ames Precision Machine Works.	**Portable Hardness Testers**—Folder "Rockwell Hardness Made Easy" describes the Ames portable hardness testers. (Page 220)
A-7-180	Armour and Co.	**Abrasive Components**—Individual booklets are available on Armour Back-Up Pads, Storing Abrasives, and the Back-Stand Belt Method. (Page 180)
A-7-182	The Atrax Co.	**Boring Tools**—New 88-page manual and catalog of carbide tools discusses the advantages of Atrax tools. (Page 182)
A-7-11	Axelson Mfg. Co.	**Lathe Tracer Attachments**—16-page bulletin describes the new Axelson Trace-O-Matic attachment in detail. (Page 11)
A-7-162	The Baird Machine Co.	**Transfer Presses**—Bulletin describes Baird transfer presses. (Page 162)
A-7-219	Bay State Abrasive Products Co.	**Abrasive Products**—Literature is available on safety in all phases of grinding. (Page 219)
A-7-164	The Bellows Co.	**Hydraulic and Air Cylinders**—Bulletin HC-600R, "Hydraulic Control of Air Power" points out advantages of Bellows hydraulic and air cylinders. (Page 164)
A-7-18	Brown & Sharpe Mfg. Co.	**End Mills**—Catalog 35C gives complete line of Brown & Sharpe End Mills. (Pages 17-18)
A-7-128	Buck Tool Co.	**Grinder Chucks**—New catalog tells of economies and advantages of Buck chucks. (Page 128)
A-7-23	The Cincinnati Shaper Co.	**Shapers**—New illustrated catalog N-6 describes the special features of Cincinnati shapers. (Pages 22-23)
A-7-139	Cleveland Tapping Machine Co.	**Bolt Threading Machines**—Catalog TE-74 describes advantages and economies of Cleveland tapping machines. (Page 139)
A-7-231-2	Colonial Bushings, Inc.	**Drill Jig Bushings**—"Flip-a-Page" catalog, B-649, states advantages and prices of Colonial drill jig bushings. (Page 231)
A-7-172-1	Comtor Co.	**Hole Gages**—Bulletin 48 describes advantages and adaptability of Comtor-plug precision gages. (Page 172)
A-7-167	Delta Drill Unit Div. Rockwell Mfg. Co.	**Air & Hydraulic Drill Units**—New drill unit catalog describes, teaches and points out the various sizes of drill units. (Page 167)
A-7-158	The Denison Engineering Co.	**Hydraulic Presses**—Bulletins give case studies and applications of presses in the one to 75-ton pressure range. (Page 158)
A-7-133-1	Detroit Stamping Co.	**Toggle Clamps**—Catalog describes applications and advantages of De-Sta-Co Toggle Clamps. (Page 133)
A-7-201	DeVlieg Microbore Co.	**Boring Units**—Illustrated catalog discusses the precision of various operations obtainable with Microbore clusters. (Page 201)
A-7-178	Erickson Tool Co.	**Holding Tools**—Catalog K points out the advantages of Erickson precision tools, collets and chucks. (Page 178)
A-7-233	Ex-Cell-O Corp.	**Boring Machines**—All facts concerning Ex-Cell-O boring machines are contained in catalog. (Inside back cover)
A-7-229	Gisholt Machine Co.	**Superfinishers**—Textbook "Wear and Surface Finish" is fully illustrated and authoritative. (Page 229)
A-7-198	Hannifin Corp.	**Riveting Machines**—Bulletin 150 gives the full story of Hannifin "High-Power" Riveting machines. (Page 168)

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THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-7-30	The Hartford Special Machinery Co.	**Universal Drilling Machines**—New Bulletin UM-100 gives complete information and specifications of Hartford drilling machines. (Page 30)
A-7-210	Haynes Stellite Co., Div. of Union Carbide & Carbon Corp.	**Cutting Tools**—"Haynes Stellite Metal-Cutting Tools" tells how to increase production and cut costs. (Page 210)
A-7-150-2	Johnson Gage Co.	**Thread Gages**—New illustrated literature explains how to get maximum thread control at lowest cost. Specify Form C-RR-54. (Page 150)
A-7-10	Jones & Lamson Machine Co.	**Dieheads and Chasers**—New catalog "Operator's Manual" describes the Tangent Die Head. (Page 10)
A-7-124	Kling Bros. Engineering Works	**Friction Saws**—Bulletins give detailed information on how friction saws work and what they can do to save production cost. (Page 124)
A-7-212	Lepel High Frequency Laboratories, Inc.	**Induction Heating Units**—36 illustrated pages give valuable information on high-frequency induction heating. (Page 212)
A-7-130	Linde Air Products Co.	**Flame Plating**—Booklet, Form 8065, contains information on flame-plating. (Page 130)
A-7-149	Lipe-Rollway Corp.	**Screw Machine Feeds**—Booklet gives details on Lipe's AML Bar Feed. (Page 149)
A-7-145-1	Magna Driver Corp.	**Screwdrivers**—Folder 95-E gives information and prices for Magna bit holders. (Page 145)
A-7-192	M.B.I. Export & Import Ltd.	**Combination Mills**—Illustrated Brochure 103 describes the variety of machines obtainable. (Page 192)
A-7-176-2	Metal Carbides Corp.	**Carbides**—Catalog 54-G discusses the various types and applications of Talide products. (Page 176)
A-7-200	Micromatic Hone Corp.	**Honing Machines**—"Cross-Hatch," Vol. 6, No. 1 gives complete description of new Microflat machine. (Page 200)
A-7-145-2	Morton Machine Works	**Fixture Components**—New catalog is concerned with fixture clamps and fixture details. Also contained are full-size tracing templates of each product. (Page 145)
A-7-122	Oakite Products, Inc.	**Industrial Cleaning Equipment**—44-page illustrated booklet on metal cleaning discusses various operations performed with Oakite equipment. (Page 122)
A-7-159	The Ohio Crankshaft Co.	**Induction Heating Equipment**—Bulletin "Typical Results of Tocco Induction Heating for Forging" discusses Tocco's induction heating equipment. (Page 159)
A-7-196-1	Palley Supply Co.	**Government Surplus**—New 320-page catalog illustrates and gives prices of surplus government equipment. (Page 196)
A-7-196-5	Rahn Granite Surface Plate Co.	**Surface Plates**—Booklet gives details for surface plates, angle plates, straight edges and parallels. (Page 196)
A-7-127	Rotor Tool Co.	**Air Hand Grinders**—Bulletin 43 tells of the economies available by using Rotor tools. (Page 127)
A-7-4	Standard Gage Co., Inc.	**Gages**—Brochure "New Products" gives details of the various varieties of gages made by Standard. (Page 4)
A-7-110-1	Standard Parts Co.	**Fixture Keys**—66-page catalog describes the over 500 tool components made by Standard Parts. (Page 110)
A-7-157	Sundstrand Machine Tool Co.	**Machine Tools**—New book No. 745 covering the following subjects: Tips on Tool Setting, Multiple Tool Turning in Small Lots, and Special Turning. (Pages 156-157)
A-7-133-2	Syntron Co.	**Parts Feeders**—Company catalog gives data on automatic, control feeding devices. (Page 133)
A-7-202	The Taft-Peirce Mfg. Co.	**Gages**—Handbook describes thread plugs, rings and snaps, special gages and other items. (Page 202)
A-7-19	Vascoloy-Ramet Corp.	**Carbide Tools**—Toolholder Catalog and Price List VR-436 describes carbide inserts and toolholders. (Page 19)
A-7-173	Waldes Kohinoor, Inc.	**Grooving Tools**—20-page technical manual contains full engineering data. (Page 173)

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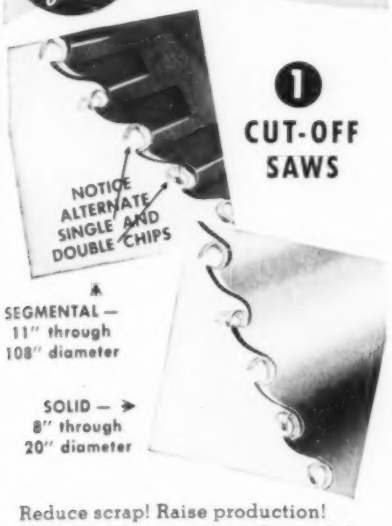

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INDICATE A-7-137-1

Abstracts of Foreign Literature

By M. Kronenberg

Logarithmic Diagrams for Machine Tool Design

The selection of the best possible gear train and of the suitable drive motor for machine tools often requires tedious calculations; these calculations must be repeated frequently, particularly when the basic elements of the machine are used for several designs. It is then necessary to check whether the motor and gear train meet the additional requirements, or whether it is possible to include another item by, say, a small change in the gears.

To simplify such work logarithmic diagrams have been developed by O. H. Blaum as described by him in an article in the May 1954 issue of *Werkstatt und Betrieb*. Two such diagrams must always be used together. One prepared on tracing paper is placed above a second one. The quantities which can be taken into consideration include cutting speed, cutting force, feed rate, gear transmission, efficiency, work-diameter, horsepower, spindle revolutions and motor torque.

The author gives as an example an instance where a customer wanted a machine built for machining of steel at 100 feet per minute. Cutting force was not to exceed 1000 lb when workpieces ranging from 1½ to 8 inches diameter were faced at constant cutting speed. In addition, the machine should be used for finishing operations limiting the cutting force to 160 lb at the corresponding cutting speed. Finally, the customer wanted to know the cutting force which could be maintained at a cutting speed of 1000 feet per minute for the machining of nonferrous metals. The job included also the calculation of the type of drive motor (d-c) for 2250 rpm and of the gear train transmissions.

Using a diagram on which are plotted, logarithmically, cutting speed and cutting force as coordinates and kilowatts as inclined lines in the field, and another one where the torque is plotted against spindle rpm, again with the kilowatts as inclined lines in the field, the author shows how it is possible to re-

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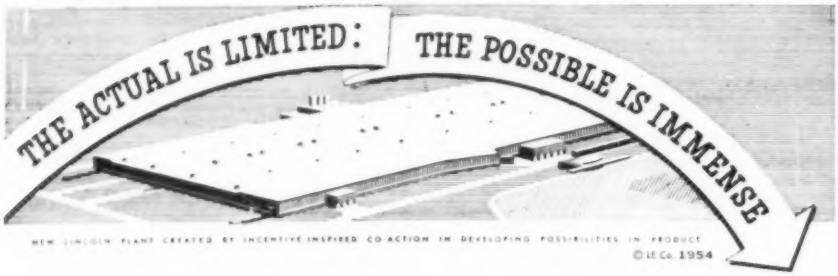

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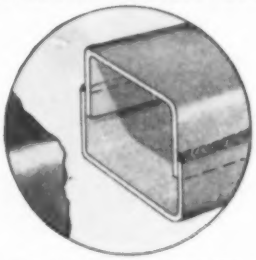

Fig. 1. Two U-shaped stampings *of hot rolled carbon steel are automatically welded into frame side rails. Speed . . . 36 seconds. Only two operators required per machine for complete operation.*

Fig. 2. Completed frame assemblies *are twisted and vibrated severely to test strength of machine welds. No fracture of welds has ever occurred.*

HERE'S HOW

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AUTOMATIC welding of automobile frame side rails has increased output by 5 times. Four automatic Lincoln machines now weld 80 rails per hour at the Frame Division, Murray Corporation of America, Ecorse, Michigan.

Each machine has 6 Lincoln "hidden-arc" heads which weld at speeds of 120 inches per minute. Entire operating cycle per rail is only 36 seconds. All operations, including welding, clamping, feeding of wire and flux, tracing and slag removal, are fully automatic. After welding, the heads retract and the assembly is kicked out by ejector pins.

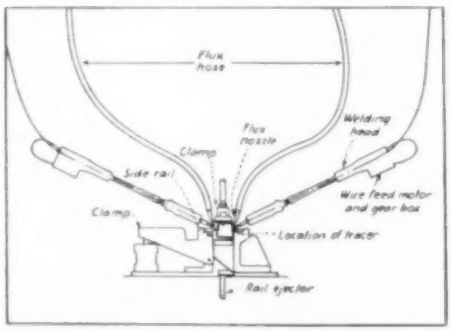

Fig. 3. Automatic "hidden-arc" welding *heads move into position after side rail is clamped. Heads guided along seams by tracer and contour compensating device for 1/32" alignment of wire and joint.*

Welding speed is increased 400% over previous manual welding. Controlled time cycle and uniform heat input keep frames within 1/8" end tolerance—less than possible with hand work. Cratering is eliminated. Entire operation uses only 25% of floor space previously required.

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solve all problems involved in short time. Changes can easily be made without repeating the entire calculation by drawing another line on the diagrams.

New Research Institute for Metal-Cutting Tools

Sponsored by the Association for the Promotion of Research and Development in The Tool Industries (Verein zur Foerderung von Forschungs- und Entwicklungsarbeiten in der Werkzeugindustrie) a new institute has recently been inaugurated at Remscheid in Western Germany, according to a report published in issue number 5, 1954 of *Werkstatt und Betrieb*. This institute is concerned with investigations of cutting tools. It began the work some time ago, before moving into the new buildings. Reports of the research work were prepared by H. Opitz, M. Leveringhaus and E. Barz. Mr. Opitz discussed the wear of cutting tools. He indicated that temperatures at the cutting edge can now be measured by means of an electric spark method, producing small holes in the vicinity of the cutting edge which can be used for thermo-elements. Mr. Leveringhaus discussed "Quality Problems in the Tool Industries." From this report it can be concluded that some new tool steels have been developed permitting induction heat treatment. Tests have also been run to compare the performance of forged and cast milling cutters, from which it was concluded that precision cast steel will become a significant material in the competition among tools materials.

Vibration in sawing blades was investigated by means of a recording oscillograph, permitting a greater accuracy and uniformity in the blades than by previous methods. Elastic deformations were measured and data obtained on the stress conditions, causing flutter of the blades. Strain gages were employed for complex tools and a new microscope was developed for testing files. The future program of the institute covers investigations of: cutting performance and vibration in tools and means for their improvement, testing internal stresses in tools, development of productions control methods on the basis of these tests, and testing of new materials.

High Speed Milling

A discussion on the advantages and disadvantages of high cutting speeds in milling operations has been resumed by H. Koop in an article in the April, 1954 issue of *Werkstattstechnik und Maschinenbau*. This deals with milling of spline shafts and gears. The author comes to the conclusion that an increase in either speed or feed rate causes an

increase in tool wear. However, Rapp, whose tests have been run in the United States, claims that a cutting speed of about 200 feet per minute or a feed rate of 0.070 inch per revolution was least efficient, while lower or higher speeds or feeds showed considerable improvements in production.

Koop's investigations showed a rapid decrease in production with increase in speed from 65 pieces per grind at a cutting speed of 75 feet per minute to 6 pieces per grind at 375 feet per minute. In this discussion, it must be kept in mind, in this writer's opinion, the cutting conditions were such as to restrict a free chip formation, because the cutting takes place in a groove when milling spline shaft, or cutting gear teeth.

Koop agrees with Rapp as far as the improvement in surface finish with increasing speed is concerned. He found a considerably smoother surface when the speed was increased to about 300 feet per minute, but claims that tool life was then so poor that much remains to be desired in this field of machining.

Design of Machine Tools

What the European customer thinks about various features of machine tools is discussed in an article by E. Broedner, published in the Swiss magazine *Industrielle Organization*, issue number 3, 1954.

He indicates that general promotional terms such as "the main spindle is made of high-quality steel" or "high production milling cutter" are considered poor salesmanship—creating the impression that no definite information can be given that would appeal to the superintendent, master mechanic or whoever may be responsible for purchasing machine tools.

Instead, the author suggests use of a questionnaire which he has prepared and which he submits to tool engineers for their consideration. He covers precision testing, data on bearings, electrical equipment, handling time, cleaning and other such items.

Among them the following may be mentioned because they show the general trend of what is considered necessary information: alignment data, adjustment of gibs, backlash elimination, heat treatment and hardness of guide ways, data on vibration and rigidity of bed and machine parts, chip disposal, type of lubrication, deformation and thermal expansion under load, accuracy of feed reversal, roughing accuracy, finishing accuracy, bearings and their protection against chips and water, directional operation of levers, installation of pneumatic fixtures, recirculation of coolant and safety features.

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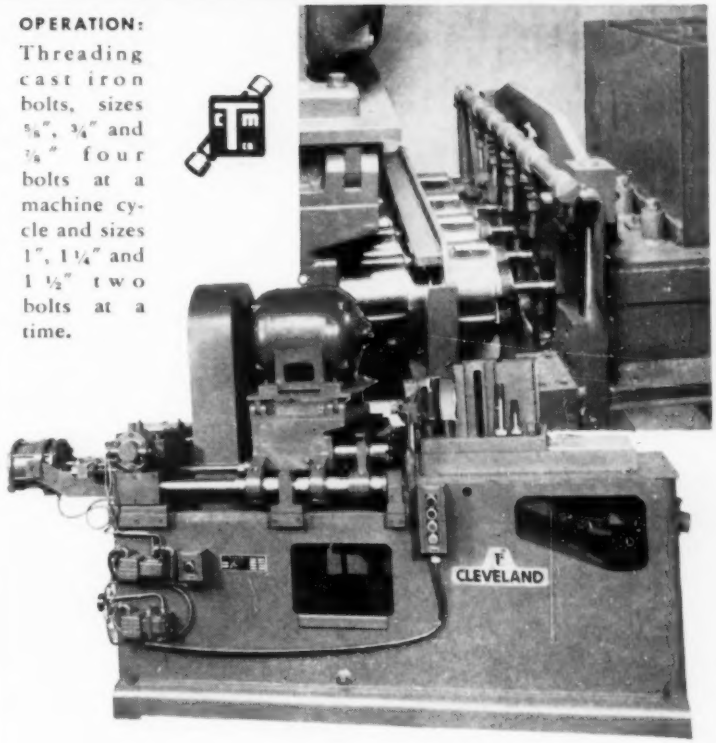

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The four-spindle head is driven continuously by the drive motor, feed in by lead screw and split nut, rapid return by air.

On the front of the machine, an air-operated slide to take interchangeable jaws for taking bolts from the bottom of stack magazines and moving forward to threading position. The bolts are clamped into position by an upper clamp plate operated by an air cylinder through a toggle linkage.

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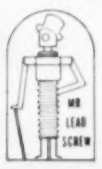

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Technical Shorts...

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PREALLOYED STEEL powder for high strength powder metallurgy applications has been developed through research at Vanadium-Alloys Steel Co. This grade, identified as 4650-A, appears to be an improvement over earlier alloy steel powders. To the user, this improvement means fabricators will be able to produce high strength parts by briquetting and sintering without resorting to secondary treatments any more elaborate than simple hardening. Due to improved toughness and hardenability of the new development, manufacture of gears and other high strength, high production parts from powder will be possible—and will likely offer significant cost savings.

According to the researchers, the powder steel has excellen green strength, and is readily mol ble a low pressures to yield dens strong compacts. Its other character ics in clude ease of heat treatment, t ghness comparable to alloy steel a high strength.

Basically a nickel, molybden n com position, the grade also is a ailable with other carbon contents.

Lab to Study Oil Hydraulics

ESTABLISHMENT OF AN educational and research laboratory in oil hydraulics has been made at the Illinois Institute of Technology. According to Dr. Victor L. Streeter, research professor of mechanics, the lab was created at the request of numerous industries now using oil hydraulics. This subject of oil hydraulics is becoming increasingly important, he pointed out, because it can deliver more power than electricity for a given weight or space. In the modern factory, most machine tools are powered or controlled by this means. At the same time, increased use of automation is bringing still greater demand.

Considered the most complete facility in this country, equipment for the laboratory has been donated by industries in the oil hydraulics field.

Among the new laboratories activities will be to provide broad educational programs ranging from intensive short courses to graduate level. First of the short courses will be given this summer.

Electromagnetic Pumps Patented

TWO PATENTS have been granted recently to the inventor of two types of electromagnetic fluid pump. The first relates to an improvement that pertains particularly to a magnetic and fluid channel structure in which the induction motor principle is utilized in such a manner that fluid pressure and flow are enhanced.

The second patent is for pump of the type in which an electrically conducting fluid is impelled along a channel by the magnetic force. The force results from an electric current passing through the fluid in a magnetic field. Utilization of this force causes a rotary motion of a liquid mass and the pressure head is obtained from the consequent centrifugal force.

Both developments were the work of N. J. Godbold.

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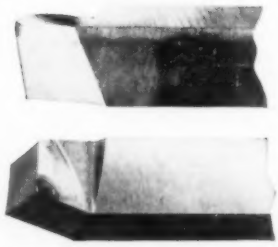

The cutting tool at top shows abnormal front clearance caused by excessive chemical activity of cutting fluid. The lower cutting tool shows cratering from insufficient chemical activity of cutting fluid.

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technical digests

Press Automation

increases productivity, improves quality, reduces materials handling

By T. W. Bannon

Chief Engineer
Clearing Machine Corp.
Chicago, Ill.

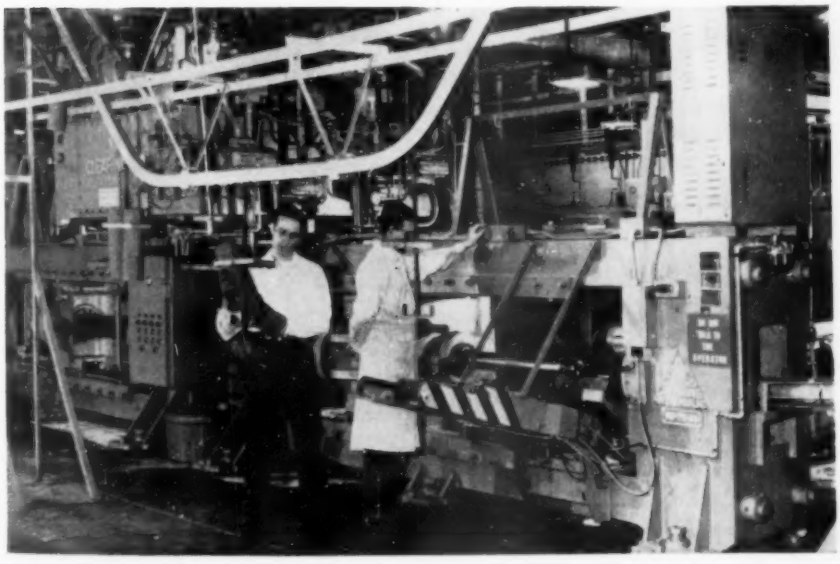
AUTOMATION OF PRESSES started with the use of combination tools or dies on single action presses so that more than one operation could be performed on a single workpiece. Then came double and triple action presses as well as multiple station presses. Essentially, the double and triple action presses combined the function of several presses. Later, transfer feed presses were developed.

Among the great strides made in feeding and unloading of the larger presses is the use of electronic devices on high-speed blanking and drawing presses. Magnetic feeds and transfers have also come in for a considerable amount of deserved recognition.

Some examples of recent automatic presses will give an idea of the present status of press automation. Recently a new kind of hydraulic press was designed and built for the production of cartridge cases. A press for drawing a shell to a final length of 24 inches requires an unusually long stroke. The equally long return stroke necessarily slows down production time. One way of reducing lost time is to produce at both ends of the stroke, eliminating lost motion. The double end press, *Fig.* 1, does just this and has a number of other automation features too. Each press has an automatic feed, *Fig.* 2, especially adapted to its function. Safety limit switches on the presses make certain that the case is properly positioned before the press will operate.

Three completely automatic shell forging units recently built each consist of three automated presses and an automatic descaler. These presses forge a 75, 90, or 105-mm shell case without a human hand touching the piece-part. The machines run continuously and have a capacity of six shell forgings a minute. The presses are completely automatic, even to the point where the scale is cleaned from the dies and the lubrication furnished to the presses between each cycle.

Fig. 1. Double-end press punches on both ends of the stroke.



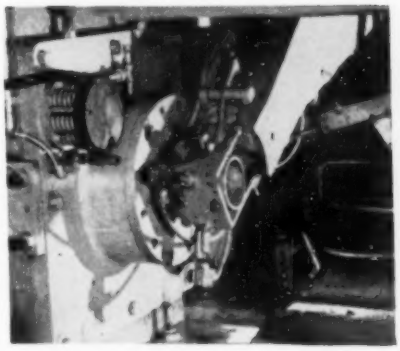


Fig. 2. Press loading mechanism. Parts are stacked in the loading chute by hand. After each piece is punched it is transferred automatically to the next operation by a conveyor.

Most presses built in the future will lend themselves even more to a complete automated setup. Trends in press design will be to complete stampings in one or two presses. Feeding and unloading components will become standard equipment as well as electronic controls for actuating the press. Or perhaps, even the entire press line will be operated from one master control panel.

Cycling rates will be boosted even higher. New methods of simplifying and combining operations will undoubtedly be developed, as they have been for other manufacturing processes.

The advancement of automation will not only depend on the press builders and machine tool builders but also on the users. To operate a fully automatic machine with complete automation to perform these complicated operations,

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skilled maintenance and operator personnel are necessary. Automation will eventually reach the job shop level but users and builders alike will have to supply some difficult answers.

Presented as part of the panel on automation at the 1954 Machine Tool Electrification Forum, sponsored by the Westinghouse Electric Corp., Buffalo, N. Y.

▼ ▼ ▼

Tooling with Plastics

by N. Mark Hastings
Chief Chemist, Resolin, Inc.
Los Angeles, Calif.

In addition to the generally known cost savings obtained through the use of plastics for tooling, there are other well founded advantages. These include the reduction in weight, simplicity of manufacture, elimination of grinding and polishing, shorter tool-making time, practicability of larger tools, excellent wear resistance, flexibility of plant layout, possibility of high quality work without highly skilled operators and the ease of production of intricate shapes and contours. Use of laminates for tooling places much more stringent dimensional requirements on the laminates than in normal use as a part. As a mold, the laminate is continuously subjected to temperature and chemical conditions which require maximum properties in the resins to avoid distortion and degradation. For these reasons, plastics used for part fabrication are generally unsatisfactory for laminating tools.

While plastic tools have many advantages as indicated, the basis for their use is the same as for any other machine or tool used in industry. If no advantage results, they should not be used. To determine the benefits which will result and to take full advantage of such benefits, it is necessary that properties, processes and utilities be fully understood.

Cast Tooling

For cast tooling, a liquid modified phenolic casting resin is mixed with an accelerator at room temperature and poured into molds and cured at a temperature of 200 F. The resultant casting duplicates exactly dimensions contour, and finish of the mold. The cured casting remains dimensionally stable.

Drop hammer die with cast phenolic type punch used to produce parts shown in foreground. Due to exceptional metal flow, the part has a better than usual cross section.

This type of casting is used for laminating molds, matrices for metal laminating molds, plastic forming dies, metal forming dies, casting molds for casting other materials, and fixtures for checking, drilling, routing, sawing, assembly masters and models.

Reinforced Cast Tooling

For reinforced cast tooling, the mixture above is allowed to thicken at room temperature and is then poured over a

Typical Properties of Tooling Plastics

Property	Casting R-725 (Phenolic Type)	Laminating L-900 (Epoxy Type)	Hot Melt Dyform (Ethyl Cellulose Type)
Specific Gravity	1.25	1.12	1.10
Tensile Strength (psi)	5000	11,000	700 — 1200
Flexural Strength (psi)	8000	18,000	——
Modulus of Elasticity in Flexture (x 10^5psi)	5 — 7	4 — 5	——
Compressive Strength (psi)	11,000	16,000	800 — 1200
Impact ft lb/inch of notch	0.24 — .3	0.6 — .7	6.0

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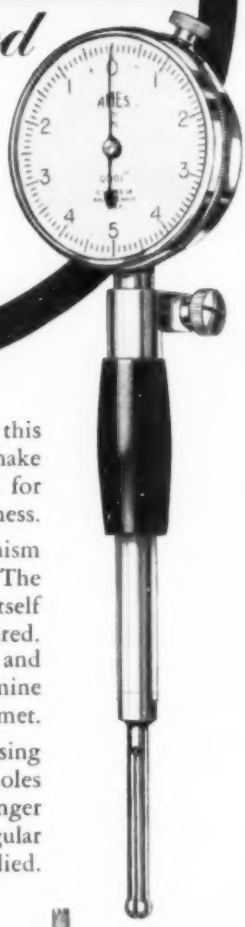

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The Ames No. 36 has extremely sensitive mechanism especially designed to eliminate "feel" in measuring. The spherical contact point automatically centers itself and indicates the true diameter at the point measured. The operator has only to slide the contact in and around the hole and note the readings to determine if tolerances are being met.

The Ames Small Hole Gauge No. 36, using contacts in increments of 1/32", can check holes of 3/16" to 1" diameter, up to 2" depth. Longer lengths and special contacts to check irregular recesses, splines, etc., can be supplied.

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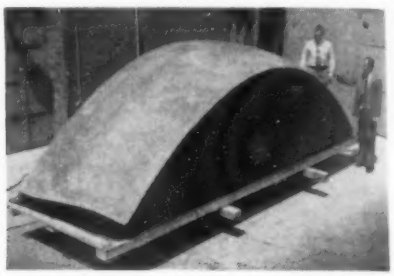
matrix to form a gelled surface. This surface is reinforced with several layers of open weave glass cloth, which is further reinforced with general layers of heavy cloth impregnated with the mix. The assembly is cured at 200°F. The resultant reinforced castings are light and tough and remain dimensionally stable under extreme atmospheric and temperature conditions. This type of casting is used primarily for laminating molds in which case it can be constructed to have heating and cooling coils or heating blankets. It can be further reinforced and stiffened with low density core for high strength use in applications named before.

Cored Cast Tooling

Another cast tooling plastic is a foam-in-place modified phenolic which is mixed with a foaming agent and catalyst. It expands to as much as ten times the original volume and hardens in this state. It can be mixed and poured in large volumes.



Laminating tool with foam core.

This foam plastic is usable with a cast tooling plastic in many combinations to provide low cost weight stiffness ratio for applications such as stretch press dies, and other metal forming and plastic forming tools. Other coring media may be used instead such as metal, paper and glass honeycomb, and other materials.

Laminated Tooling

These are epoxy laminating resins which when mixed with a hardener and applied to a metallic or nonmetallic surface will harden in six hours at ambient room temperature. Resultant product duplicates exactly dimensions contour and finish of the mold. The cured part retains dimensional integrity. No special equipment is required. This material is generally used with open weave, heavy glass fabrics to produce glass reinforced laminate tooling for such applications as fixtures, lay-up and laminating molds, matrices, plastics form-

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ing and metal forming dies. Used with the previous types of tooling plastics, it provides high strength, low cost tooling for applications mentioned previously

Drill fixture of epoxy type laminating resin.

and for metal forming tooling such as drop hammer and punch press tooling alone or in combination with a thermoplastic high impact tooling plastic.

Laminated and Hot Melt Tooling Combination

An ethyl cellulose based hot-melt thermoplastic materials provides a tough high impact property which, when utilized in combination with a laminated mating punch or die or metal punch or die, provides a combination for drop hammers to produce quality formed metal parts. This type of tooling plastic requires a melting kettle for melting and pouring.

Other Considerations

Tool size is relatively unimportant in fabricating by any of the methods and materials described. Tools varying in size from extremely small to dimensions up to 5 by 30 feet and using material quantities up to 5,000 pounds in one tool have been produced. Because of low density of tool plastics, large sizes do not impose too great a burden on average handling equipment. Since plastic tools are molded or cast to shape, contour and finish, no hand barbering is required. Finishing resolves itself into trimming and cleaning edges and back to provide proper supporting structure. For this conventional shop equipment may be used. All of the materials described are readily repaired either on the job or in the tool shop, so that all original physical properties are retained.

From a paper presented at the 1954 technical and management conference, Society for Plastics Industry, Inc.

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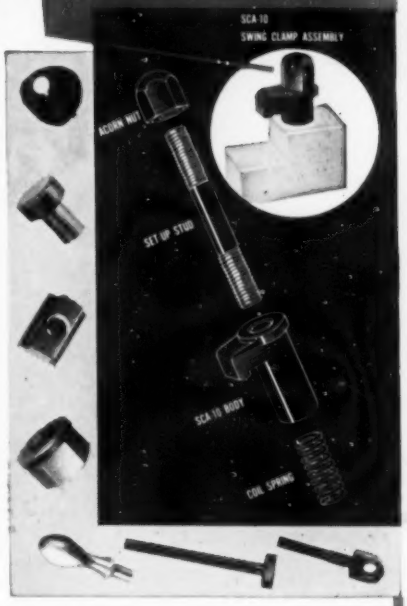

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How Far Will Automation Go?

By E. E. Opel
Electrical Engineer
National Automatic Tool Co.
Richmond, Ind.

Automation has been developing for many years. Once a clever master mechanic lined up some standard drilling machines and a crank and chain to move parts from one machine to another. He located and clamped all the parts with a hand lever. He controlled the machine cycles with another lever. One operator handling several machines—that was automation.

Much of the first automation equipment was fitted to existing machines by tool users. The trend now is to consider automation as a part of the machine tool. There is no question that automation is here to stay. How far will it go? Machine units will tend to become smaller and be connected by automation. Means will be provided for stock piling between machine units or detouring parts through parallel machine units. More safety controls will be used. Machine operators will be patrol men. Instead of moving parts from one machine to another, they will patrol the production line watching for signs of impending trouble. These men must be more capable than the old style machine operators. Maintenance will probably not be greatly increased, but inspection will be a serious problem. Automatic inspection will be used for depth of holes, size of holes, location of holes, oil leaks. It seems reasonable that gages can be operated automatically. Gages are now available which will indicate good or bad parts. They will also indicate that the parts are approaching the "not go" tolerance. This will give the operator a chance to change tools before he makes much scrap. Machines will automatically eject defective parts. They will be lubricated automatically and will have many safety control features to protect themselves and to tell the operator what to do if trouble occurs. Machines will have meters to tell machine operator when to change tools.

These are some of the things the crystal ball shows on the horizon.

Presented as part of the panel on automation at the 18th annual Machine Tool Electrification Forum, sponsored by the Westinghouse Electric Corp., Buffalo, N. Y., April 6 and 7, 1954.

▼ ▼ ▼

Change Control

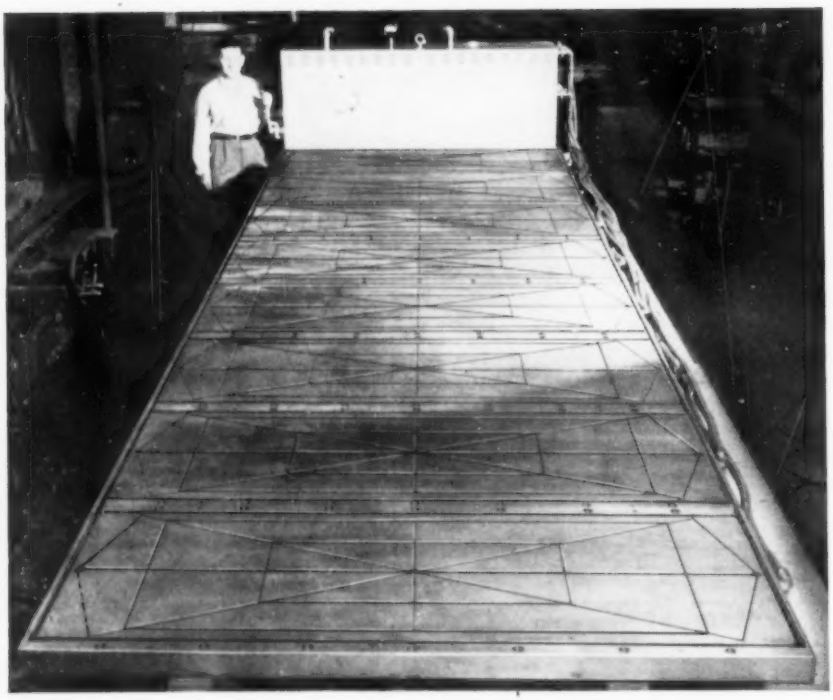
N. H. Shappell, Panel Leader
Douglas Aircraft Co., Inc.
Santa Monica, Calif.

Change control is defined as a function which provides an over-all plan and schedule for incorporation of a change to a product with a minimum of confusion and cost to the program. In order to do so, the function must coordinate with engineering, fabrication and assembly, inspection, man-power loading and employment, planning, tooling, procurement, finance and spares. All of these groups plus others, including the customer, at one time or another are affected and must be taken into consideration. Though nomenclature varies between companies, changes are commonly classified under one of the following heads: safety, mandatory, negotiated, miscellaneous.

A routine type of change is generally originated by the tooling department or various shop departments in the company. This type is effective on a block or lot of airplanes, scheduled far enough in the future to allow normal flow time through engineering, material, tooling and the shops.

The expedited change, generally the

Walker Does It Again-



Walker, pioneer in the chuck industry, has been utilizing magnetic force to make all types of special and standard chucks since 1887.

Walker now harnesses atmospheric force for special vacuum chucks to hold non-magnetic materials. First a leader in magnetic force—now a pioneer in atmospheric force.

Hold Everything with Walker Chucks

O. S. WALKER CO. Inc.
WORCESTER 6, MASSACHUSETTS
Original Designers and Builders of Magnetic Chucks

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ety or mandatory type, as a rule is le effective on all aircraft immedi- ly as a result of executive or engi- ing decision. This change requires cial expediting through the various partments. It is almost always nec- ary to make a number of parts with tools, or the minimum amount re- uired to expedite parts. The com- anies' experimental and development departments are utilized to accomplish this. Such changes require personal handling by all agencies involved and usually result in added cost to the program. In many cases, the delivery schedule is impaired to a point where complete rescheduling of the program is required.

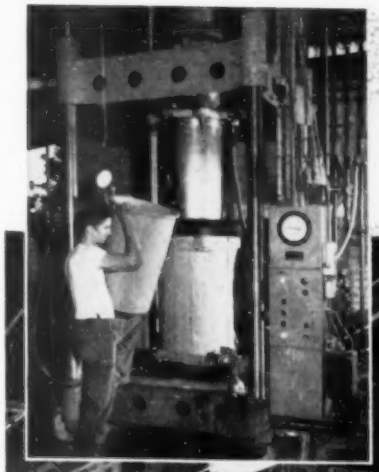
The negotiated change is generally requested by the customer, military or commercial, as an improvement to or additional requirement for the airplane. The customer normally establishes the priority. Time of the request and the time needed to process these changes has a definite effect on the ultimate delivery schedule and cost of aircraft.

Miscellaneous changes are generally minor improvements to the aircraft, improvement in assembly, fabrication or installation techniques used in various shops. As a rule, such kinds are made effective on a certain block airplane in such a manner that schedule and cost are unimpaired.

Group Responsibilities

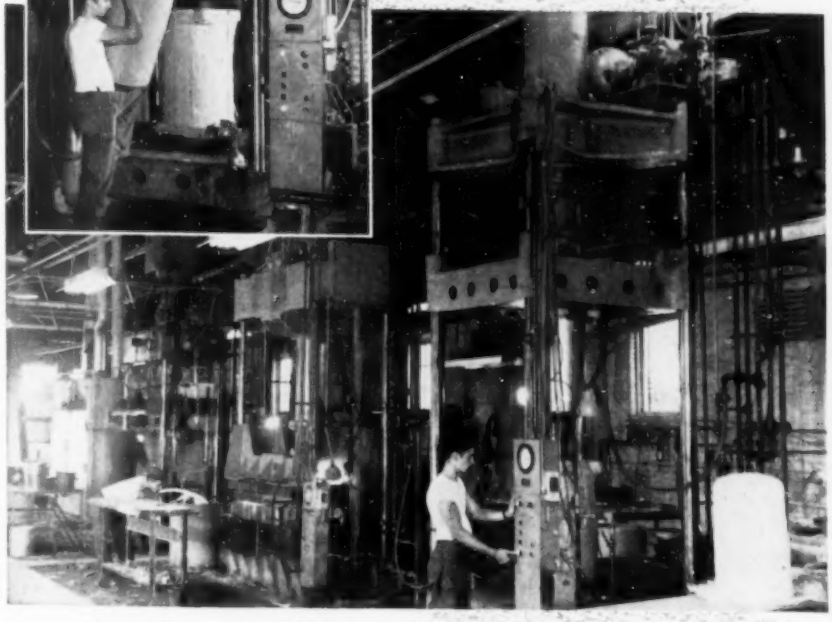
As a general rule, the engineering departments establish priority of changes, though coordination and reason for the change aid in establishing a category in the desired effective date. The change control board or group has responsibility for keeping agencies cognizant of schedule requirements and status of changes on current aircraft. By strict adherence to schedule and cognizance of the change picture excessive costs can be avoided. In handling changes affecting subcontractors the job is released by engineering as the prime contractor, processed by the planning department and given to the vendor by the subcontracting department. The subcontracting department, as a part of the purchasing department, is responsible for keeping the vendor up to date.

The inspection departments assume responsibility for verification of changes incorporated in the product. This is done through coordination of planning paper with engineering drawings for the parts involved. The planning department furnishes the shop and inspection departments with paper which notes the applicable engineering drawings for letter change involved, together with



Finished mold for electronic housing being removed from 100-ton press.

Over-all view of 80-ton, 40-ton and 100-ton Farquhar Hydraulic Presses at American Insulator Corporation, New Freedom, Pa.



American Insulator reports:

FARQUHAR HYDRAULIC PRESSES give "closer tolerances and greater strength"*

*A battery of Farquhar Hydraulic Presses currently in operation at American Insulator Corp., New Freedom, Pa., was selected originally because the presses had to be custom-made, and Farquhar was in the best position to do this. In addition to this advantage, the Farquhar Presses have now proved to be more economical in operation and capable of maintaining closer tolerances due to greater rigidity of platens. So reports Mr. W. F. Remphrey, foreman of American Insulator's reinforced plastics division.

Three presses (40-, 80- and 100-ton) are used for molding fibre glass for production of classified electronic housings. The same job that formerly required an hour to mold through a vacuum process now takes only **6** ***minutes*** on a Farquhar Press! The hydraulic presses feature an automatic cycle, with one-man loading.

Farquhar Presses Cut Your Costs

The above installation is just one more example of Farquhar performance in heavy production! Farquhar Presses are built-for-the job . . . assure faster production due to rapid advance and return of the ram . . . greater accuracy because of extra long guides on the moving platen . . . easy, smooth operation with finger-tip controls . . . longer life due to positive control of speed and pressure on the die . . . long, dependable service with minimum maintenance cost!

For a free catalog showing Farquhar Hydraulic Presses in all sizes and capacities for all types of industry, write to: THE OLIVER CORPORATION, A. B. Farquhar Division, *Hydraulic Press Dept.*, 1519 Duke St., York, Pa.

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HYDRAULIC PRESSES
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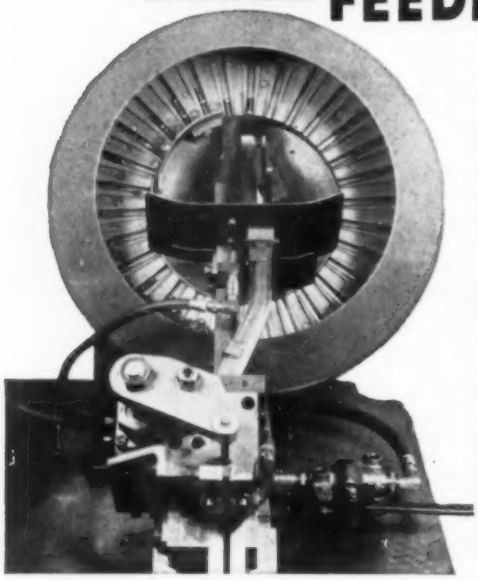

● Note the improvement in Lower Costs, Speedy Production, Quality Control and Increased Profits . . . Now, this DPS contribution to the metal-working industry is emphasized in an expanded line of selective feeding devices and engineering service . . . Tell us your requirements; we have the unit and the know-how to meet your needs.

DPS BARREL-FEEDER

● Here is an interesting case showing separate screws and lock washers that were loaded into a single feeder and ejected loosely assembled at the rate of 60 to 70 a minute . . . An amazing speed increase over slow, manual operation. In this instance, as in thousands of other applications, the unit was designed with the idea of maximum feeding of a wide variety of parts at a fraction of the cost of manual feeding.

DPS BOWL-FEEDER

Our Newest Addition

● An electric, vibrating unit that advances the parts on a circular spiral, aligning and correctly locating them to issue directly into the work area in proper time cycle. Provides fully automatic feeding of light, fragile parts that normally could not withstand tumbling.

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the applicable manufacturing and processing information. This paper is checked with the engineering drawings by inspection and recorded as being the proper change. This paper is maintained as a permanent record by the various inspection departments.

From a panel discussion at the Production Forum 1953 SAE National Aeronautic Meeting, Los Angeles, Calif.

▼ ▼ ▼

Setting up Automatic Welding Processes

By Warner H. Simon

Dresser Manufacturing Div.

Automatic welding consists of mechanical control of the variables in welding, while in manual welding, operator manipulation plays the major role in the welding operation.

The following means are suggested for the purpose of controlling the variables in automatic welding:

1. Establish prewelding standards.
2. Set up general standards of machine operations by means of calibration tests, recordings, etc. to determine the general effect of operating variables on typical production items.
3. Perform an initial setup test for each specific job to define the limits of welding variables, which should be recorded on welding test schedules.
4. Apply welding test schedules to pilot runs for production approval.
5. Maintain a current and detailed breakdown of welding defects and their frequencies.
6. Enforce quality standards in production.
7. Reduce process variations due to human element as far as possible.

The tendency in the welding industry is towards automation, i.e., the gradual elimination of the last item, the human element. Contrary to widespread conception, the welding industry is far from this ideal. However, by means of well-designed fixtures, closely controlled procedure and organized research, the ideal of fully automatic control of the welding operation is approached. This statement is illustrated by means of examples in connection with flash welding, automatic arc welding and other processes.

Only by means of systematic research can undesirable fluctuations be analyzed and minimized.

From a paper presented at the 2nd annual welding show and 1954 spring meeting of the American Welding Society.

The Effect of Alloying Elements on Welds in Titanium

By G. E. Faulkner
Battelle Memorial Institute
Columbus, O.

Welding studies were conducted on series of titanium-vanadium alloys, titanium-aluminum alloys and alloys containing combinations of the principal beta-stabilizing elements, chromium, iron, manganese, molybdenum, and vanadium, and combinations of the beta-stabilizing elements and aluminum. These tests were conducted to obtain further information concerning the effects of alloying elements on welds in titanium.

Inert-gas-shielded tungsten-arc welds were made in ⅛, ¼, and ½-inch thick plates of these alloys. The welds were tested for bend ductility, notch toughness, hardness and microstructure. Tensile tests were made on unwelded plates in each of the alloys.

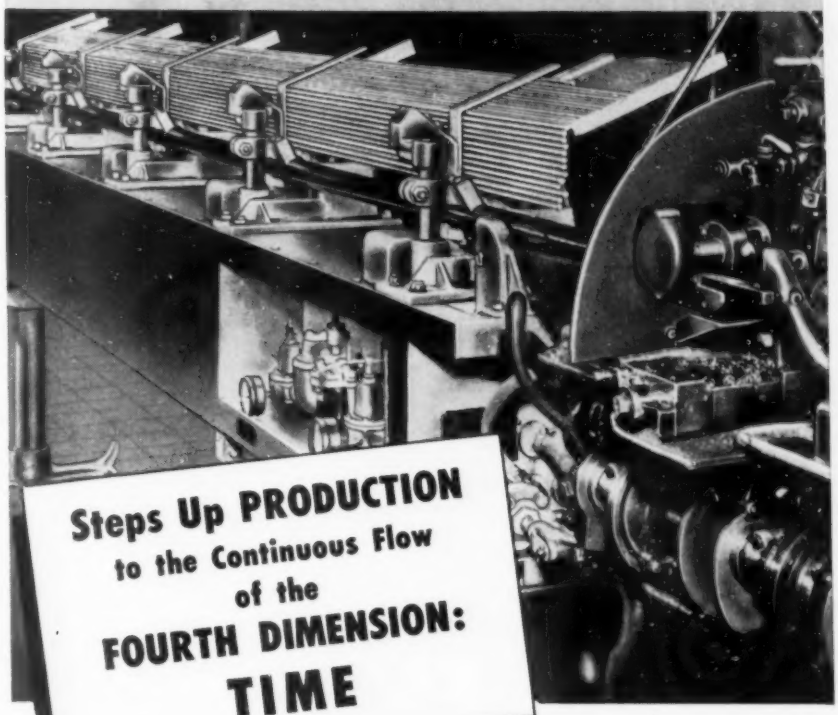
These data were compared with previously published data on the effects of chromium, iron, manganese and molybdenum on welds in titanium alloys. Vanadium had an effect on the weld joint properties of titanium alloys similar to the other beta-stabilizing elements. The ductility of welds in the titanium-vanadium alloys decreased with increasing alloy content and became low when the vanadium content approached 5 percent. The ductility of the welds could be improved, however, by heat treatment.

The ductility of welds in the aluminum alloys was good in alloys containing up to 5 percent aluminum and limited aluminum additions to alloys containing beta-stabilizing elements increased their strength but had no appreciable effect on their weld-joint properties.

Welded joints in alloys containing combinations of beta-stabilizing elements and combinations of one beta-stabilizing element and aluminum had properties similar to welds in alloys containing only one beta-stabilizing element. The weld-joint properties appear to depend primarily on the amount of beta-stabilizing elements present rather than on which individual elements are present in the alloys.

From a paper presented at the 2nd annual welding show and 1954 spring meeting of the American Welding Society.

Now... A Screw-Machine-Feed that BREAKS THE TIME BARRIER!



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There IS a definite increase in production — up to 100% on some installations — *at least* 30% *on every one!*

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Engineering Work Control

By James E. Thompson

Engineering work control is a proved technique for forecasting and controlling engineering department costs. Its purpose is to plan and control all work accomplished in engineering. It is similar to what is often termed engineering planning and scheduling and may be thought of as an extension of that function.

The basic elements, in the approximate order of the application, of engineering work control are:

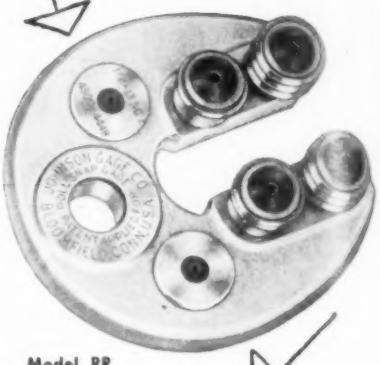
- A program planning function, to chart the course for engineering
- A work-order system, for task identification
- A work-priority system, to control work sequence
- An estimating procedure, to determine the magnitude of engineering's tasks
- A master schedule, to relate total authorized tasks to time and available manpower
- A detailed scheduling system, to establish work sequencing within each major task on the master schedule
- An hours-control procedure, to collect actual costs for comparison with estimates
- A basis for work measurement, to permit comparing progress with manpower expenditures
- An adequate system for reporting accomplishment and effectiveness, and for investigating variances
- Standardized engineering procedures, to insure a common basis for estimates.

Program planning is the prerequisite step in establishing engineering work control. This function, working in close coordination with both engineering and company top-management, establishes and maintains the master plan for engineering's operations and is the point of issuance of all engineering work authorizations. The program planning function of engineering work control has the responsibility of insuring that: (1) only necessary work will be done, and (2) the work is accomplished in the most effective fashion.

Operating controls are a very important part of work control. These consist of periodic, current reports of engineering accomplishment and effectiveness, and of all significant variances and trouble spots.

From a paper presented at the 1954 Engineering Institute of the University of Wisconsin, Madison, Wis.

JOHNSON'S new ROLL-Snap THREAD Gage



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Here is the finest designed ROLL-Snap Gage on today's market. Its huskier, simplified construction actually *lowers* its production cost which means lower prices to you.

Incorporates such exclusive features as precision ground working surfaces on frame . . . all frames, rolls and studs interchangeable . . . Go rolls have restricted end play to detect "drunken" threads . . . Not Go rolls, cone and vee type, correct for Pitch Diameter check . . . lapped steel washers to assure permanent alignment and rigidity of studs. Roll guards optional.

Where more exacting control and information is required, Johnson RING-Snap thread gages or ROLL-Snap and RING-Snap Comparators, Analyzers, and Standard Accessories are recommended.

NEW illustrated literature explaining how to get maximum thread control at lowest costs is yours for the asking (Specify Form C-RR-54)

Johnson Gage

THE JOHNSON GAGE COMPANY
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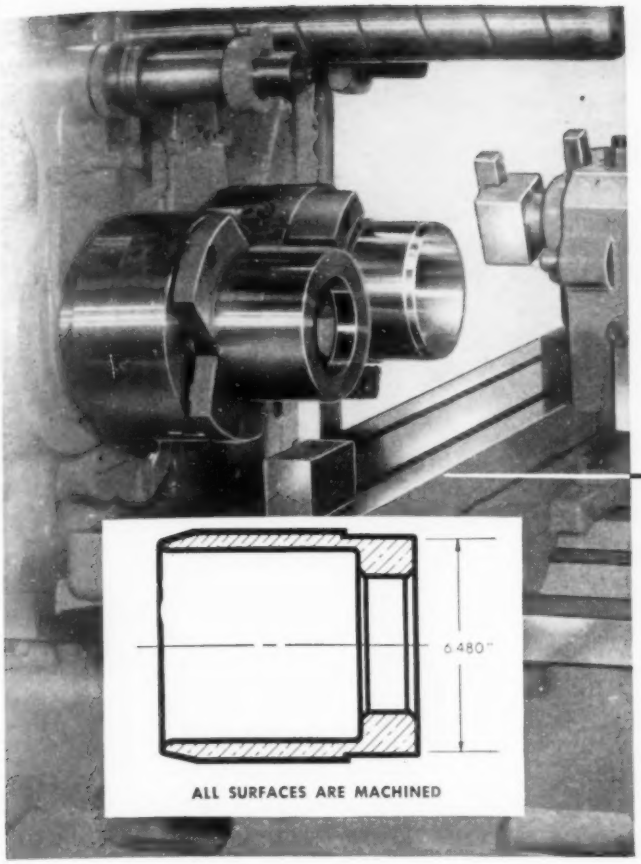

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THIS BRONZE CASTING COMPLETELY FINISHED

. . . in one turret cycle

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(FLOOR-TO-FLOOR TIME)

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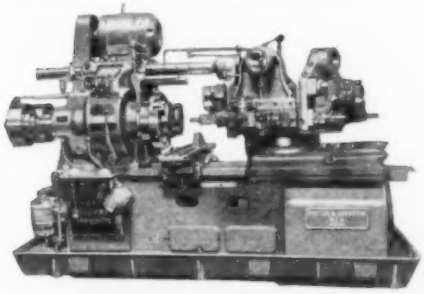
To get more production per unit of floor area, consider the P&J 2-Spindle Automatic Turret Lathe. With double spindles driven from a common power source, this machine far exceeds the output of any single-spindle type for work within its range. And you'll cut costs *FOUR WAYS*. One P&J 2-Spindle Machine uses far less power . . . costs far less initially . . . takes half the floor space . . . and is easier to operate.



Consider also features of the 5D-2 POWER-FLEX common to all P&J turning machines — automatic chucking, automatic speed and feed changes — ample power, rigidity and flexibility — time-proved construction that assures accuracy and long life, more return from your original investment.

See for yourself how the 5D-2 POWER-FLEX can bring greater profits to your plant. Send today for your copy of Bulletin 123 — or ask P&J Engineers to submit tooling recommendations based on your own prints or sample parts.

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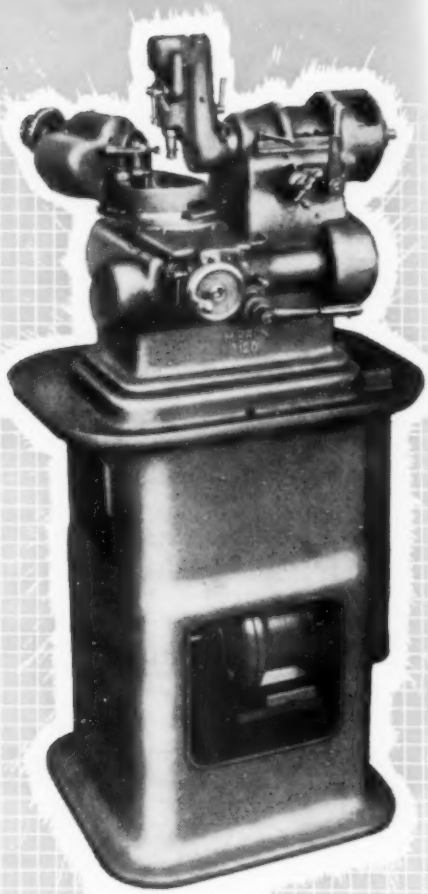

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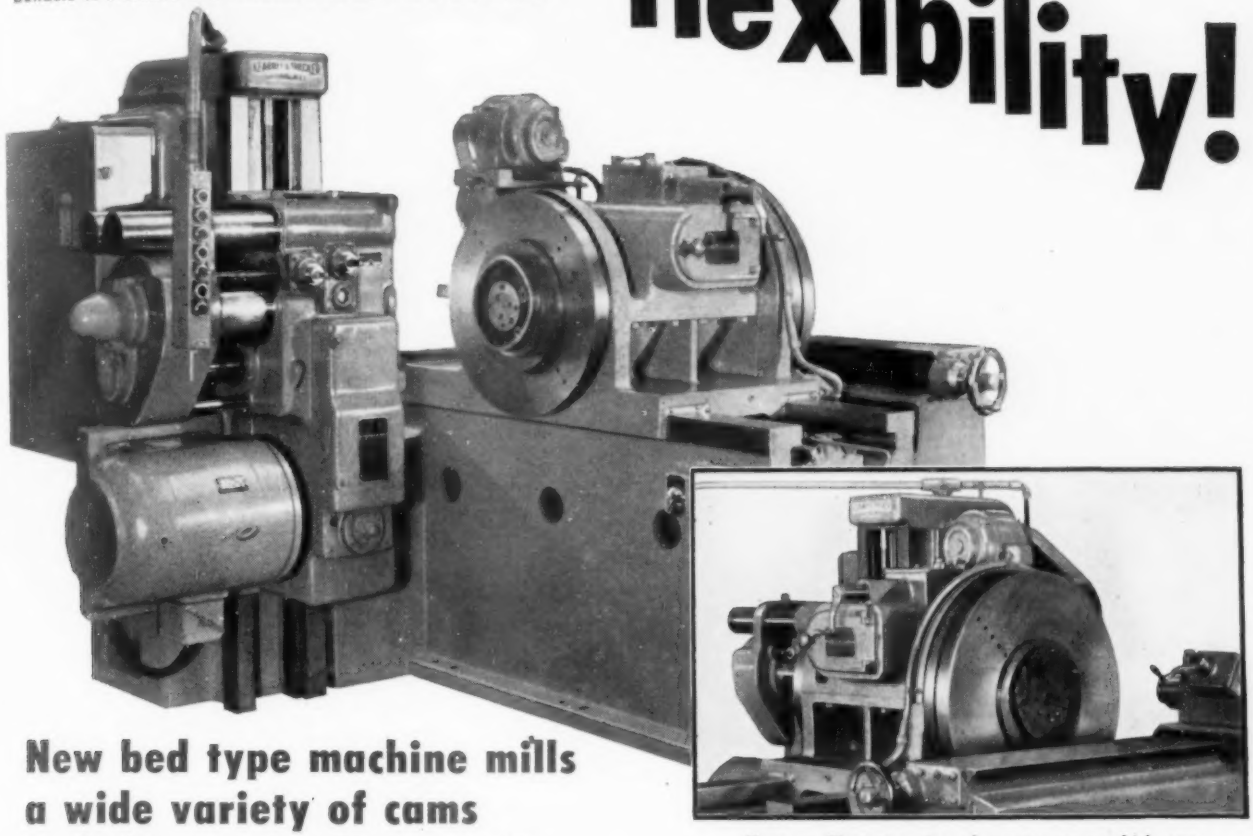

New bed type machine mills a wide variety of cams including extra large units

Close-up illustrates size of master cams which can be accommodated on this 30 in. dia. cam plate.

Designed and built by Kearney & Trecker's Special Machinery Division, this bed type cam milling machine helps improve productive efficiency for a textile machinery manufacturer. Offering a wide choice of feeds and speeds, it is capable of milling many types of cams. What's more, the manufacturer gets added flexibility because the machine also handles extra large cams.

Its features include:

- ✓ 24" dia. fixture plate . . . 30" dia. plate which accommodates master cams . . . and a cam follower head with 40" movement along the ways.
- ✓ Quill-mounted milling spindle with speeds from approx. 50 through 750 rpm through pickoff gears.
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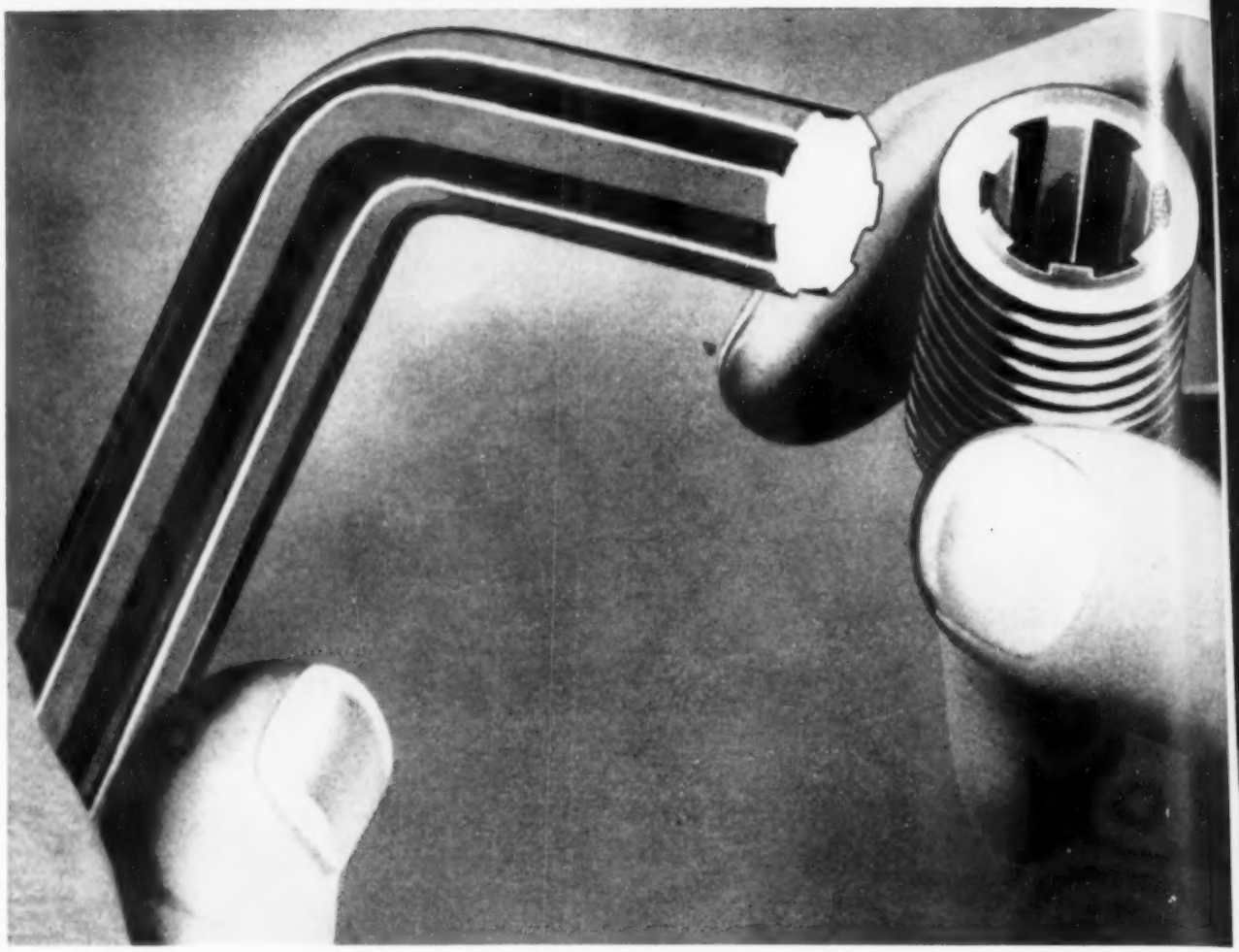

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They withstand severe shock and vibration, permitting fewer and smaller screws to be used without sacrificing strength.

While the splining principle has long been recognized as the best means of transmitting rotary power, the materials of which they are made also contribute to the tremendous holding strength of these Bristol set screws. Standard screws are made of heat-treated alloy steel; bronze, brass, monel or other metals are available on special order.

Bristol multiple-spline set or cap screws are carefully designed to close tolerance (ASA approved) in sizes from 0 wire to ½" in diameter. Get them through your regular industrial distributor.

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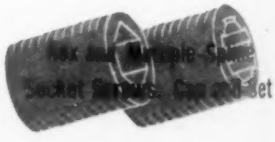

THE BRISTOL COMPANY, Socket Screw Division, Waterbury 20, Conn.

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Specialized factory service available everywhere.

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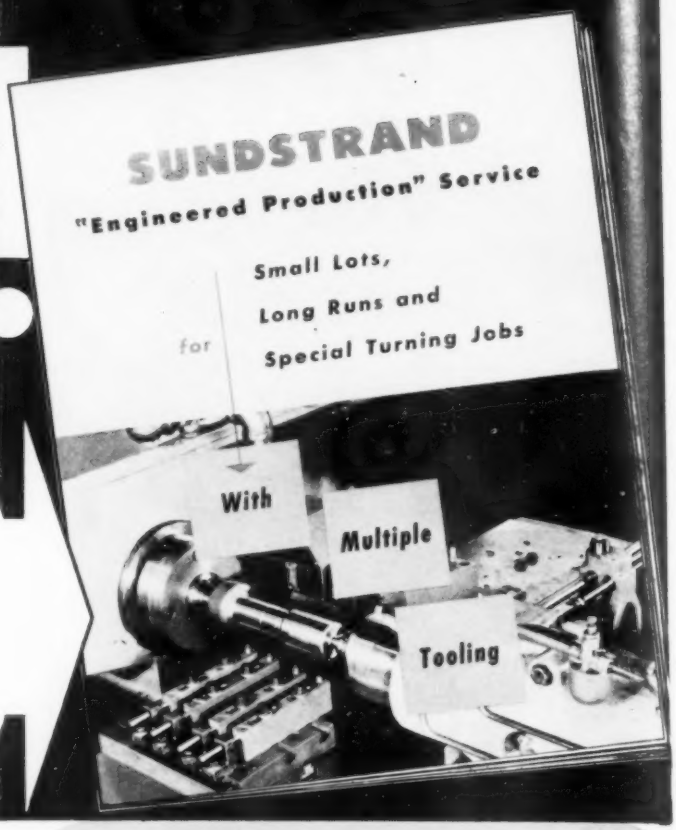

Here is some new proof of the productive versatility of Sundstrand Automatic Lathes. The information presented in this new book is taken direct from the field-checked and re-checked for accuracy and presented to you so that you may compare the performance of your present turning equipment with the outstanding performance obtained with Sundstrand Automatic Lathes in other plants.

Included in the book are on-the-job action photos and tooling diagrams describing actual applications from modern manufacturing plants.

32 PAGES OF JOB FACTS, TOOLING TIPS AND TECHNICAL DATA

Here are a few of the jobs described in this new book —

- Practical tips on tool setting.
- Turning cylinder liners.
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ALSO . . .

- How to select the proper lathe.
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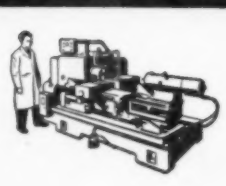

SOME OF THE VALUABLE INFORMATION YOU'LL FIND IN THIS BOOK

1 *Practical Tips on Tool Setting*

Two pages of information on setting tools five different ways includes setting tools from master samples, setting tools without master samples, setting tools from tool block gages, setting tools to template and setting tools in magazine.

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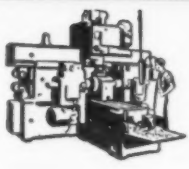
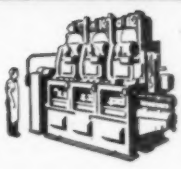
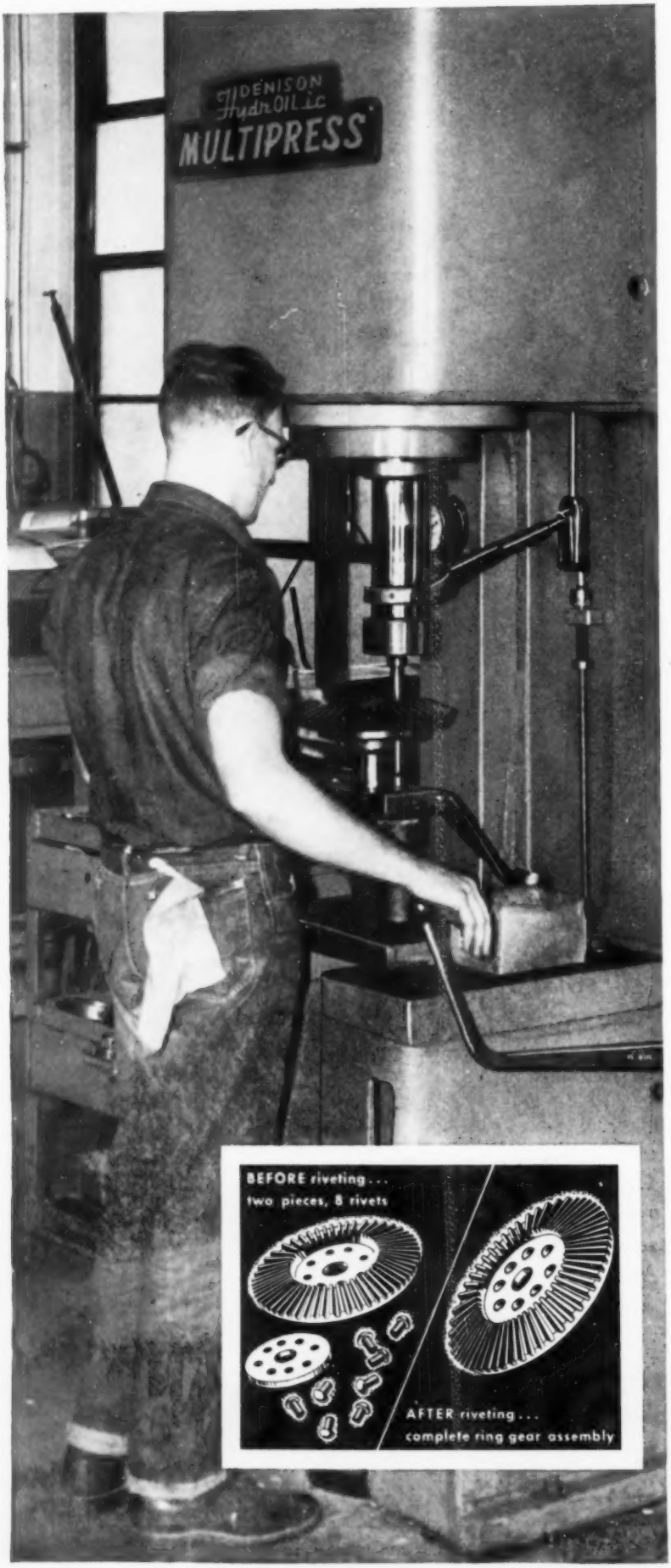
You'll find many lathe jobs similar to yours in this book. You'll also find valuable production data to compare with your present equipment. Write for your copy now. Ask for book 745.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





SUNDSTRAND
Machine Tool Co.
2540 Eleventh St. • Rockford, Ill., U.S.A.



One man, one DENISON MULTIPRESS® ... 9 times the production per man

At Barber-Greene Company, they've tripled production for riveting together two halves of a ring gear assembly.

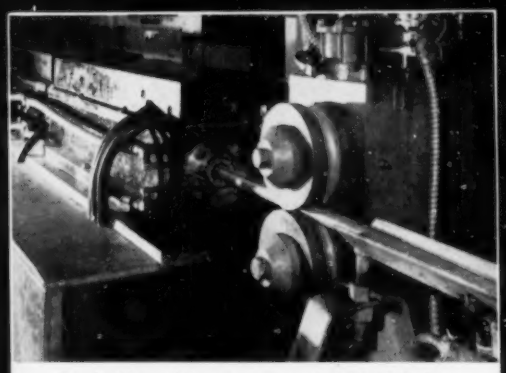
With former hot rivet method, the best a three-man team could do was 10 assemblies an hour. The operation was slow, noisy. Distortion from heat made a boring operation necessary.

With cold riveting, using Denison's hydraulic Multipress, flow of metal is better, more uniform. There's no heat, no warpage. One operator rivets 30 assemblies an hour.

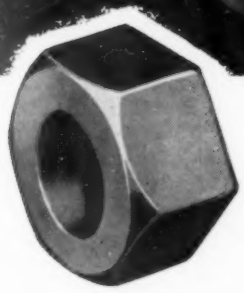
You can get the same results. Send for bulletins and case studies on applications in the one to 75-ton pressure range. Write to: THE DENISON ENGINEERING COMPANY, 1191 Dublin Road, Columbus 16, Ohio.

DENISON Hydr OIL ics

4200 Nut Blanks Per Hour



Feed rolls push barstock through TOCCO Induction Coils to heat stock to 2350°F for forging.



with TOCCO* Induction Heating

FASTER PRODUCTION—4200 nut blanks per hour—twice the output of a conventional hot punching machine—that's the result of Lamson & Sessions Company's new automatic production set up with TOCCO Induction Heating.

OTHER ADVANTAGES—TOCCO delivers exact temperatures (2350°F, plus or minus 25°) and delivers them so fast that scale has little time to form. Scale loss has been reduced to only about 1% for hot-rolled stock. TOCCO is clean and cool, fits right into the production line—no hauling to and from the heat-treat department—no unpleasant radiant heat to annoy workers.

HERE'S HOW IT WORKS—Steel bars up to 1½" diameter are fed through TOCCO Induction Coils. The first two coils, operating off a 300 kw, three kc TOCCO motor-generator set, preheat the rod. The third coil which operates from a TOCCO 250 kw 10 kc generator then boosts the rod to forging temperature. The hot rod then is fed to the special hot nut former (designed and built by NATIONAL MACHINERY CO.) which shears the rod to suitable lengths, forms the part and spits out the nut blank—ready for tapping.

In your search to find sound methods of increasing production, improving products and lowering costs, don't overlook TOCCO Induction Heating. If your products require heat treating, soldering, brazing or forging, it will pay you to investigate TOCCO for better, faster ways of producing them at lower unit costs.

THE OHIO CRANKSHAFT COMPANY

TOCCO

*Trade Mark Reg. U. S. Pat. Off.

Mail Coupon Today

FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. G-7, Cleveland 1, Ohio

Please send copy of "Typical Results of TOCCO Induction Heating for Forging."

Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State____

JIG GRINDING ACCURACY *guaranteed**

INFINITE CONTROLLED SPEEDS 30,000 TO 65,000 R. P. M.

Easily connect jig grinder to jig borer or mill

Then you can finish grind in hardened steel to "tenths" . . . jig grind dowel holes square with a ground base . . . move location of holes in hardened steel blocks . . . jig grind interchangeable holes in hardened sections . . . grind small holes with diamond impregnated mandrels . . . grind contours and relief with tungsten carbide burrs . . . grind radii in die sections . . . eliminate jig bushings in tools where close spacing is essential.

Other infinitely controlled air driven spindle applications

Place spindle on most any machine. Use it for finishing contours on hardened steel working surfaces . . . burring or milling die castings . . . routing wood contours . . . carbide milling or finishing slots . . . finishing holes in hardened steel to "tenths" . . . grinding with diamond wheels, carbide burrs, or diamond impregnated mandrels.

Advantages—10 micro finishes using carbide mills . . . 6 micro finishes using mounted points, operates at any angle . . . air driven, air cooled, overheating prevented . . . speed controlled at optimum point . . . 3⅛" long motor uses little working space . . . By controlling speed at any point you abolish need for many constant speed spindles.

For immediate quotation please state machine tool application. Get this manual of photos showing operations Vulcanaire performs.

"Dependably accurate to "tenths"

Vulcanaire

It's built by toolmakers for toolmakers

MAJOR VULCAN SERVICES

Engineering, Processing, Designing and Building, Special Tools . . . Dies . . . Special Machines . . . including the *Vulcan Hydraulics that Form, Pierce, Assemble and Size.*

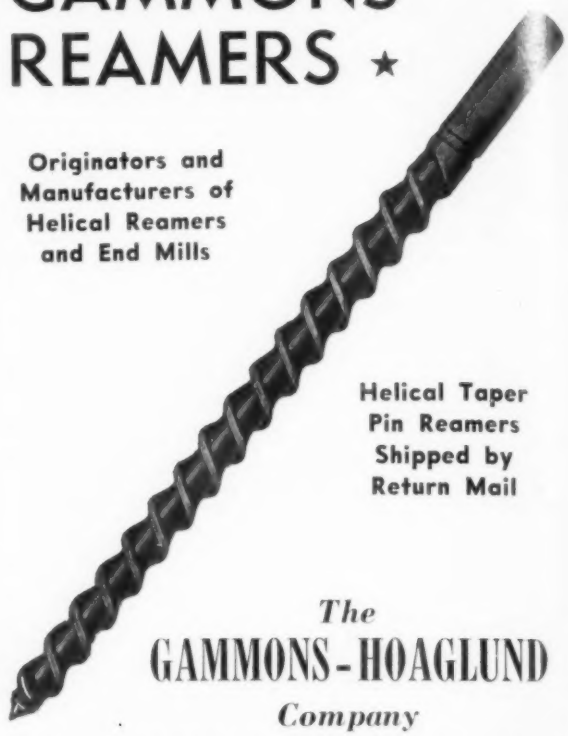
VULCAN TOOL CO.

7300 LORAIN AVENUE DAYTON 10, OHIO

USE READER SERVICE CARD; INDICATE A-7-160-1

GAMMONS REAMERS ★

Originators and Manufacturers of Helical Reamers and End Mills



Helical Taper Pin Reamers Shipped by Return Mail

The
GAMMONS-HOAGLUND
Company

400 Main Street, Manchester, Conn.

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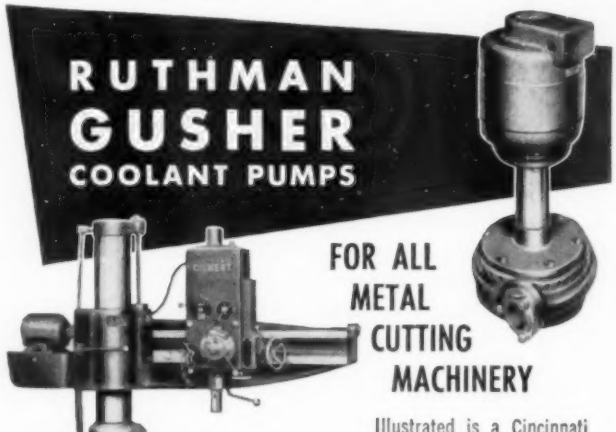
RUTHMAN GUSHER COOLANT PUMPS



FOR ALL METAL CUTTING MACHINERY

Illustrated is a Cincinnati Gilbert 4'-11" column Radial Drill equipped with a Gusher Coolant Pump.

Ruthman Gusher Coolant Pumps are better three ways

1. Gusher Coolant Pumps give you split-second coolant flow when the machine is turned on.
2. Pre-lubricated heavy-duty ball-bearings, totally enclosed drip proof motor, elimination of packing and priming, cut maintenance to a minimum.
3. Electronically balanced rotating assembly with no metal to metal contact assures long life.

Always Specify Gusher Coolant Pumps

THE RUTHMAN MACHINERY CO.

1810 READING RD. CINCINNATI, OHIO

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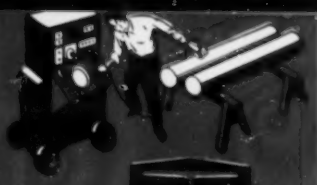
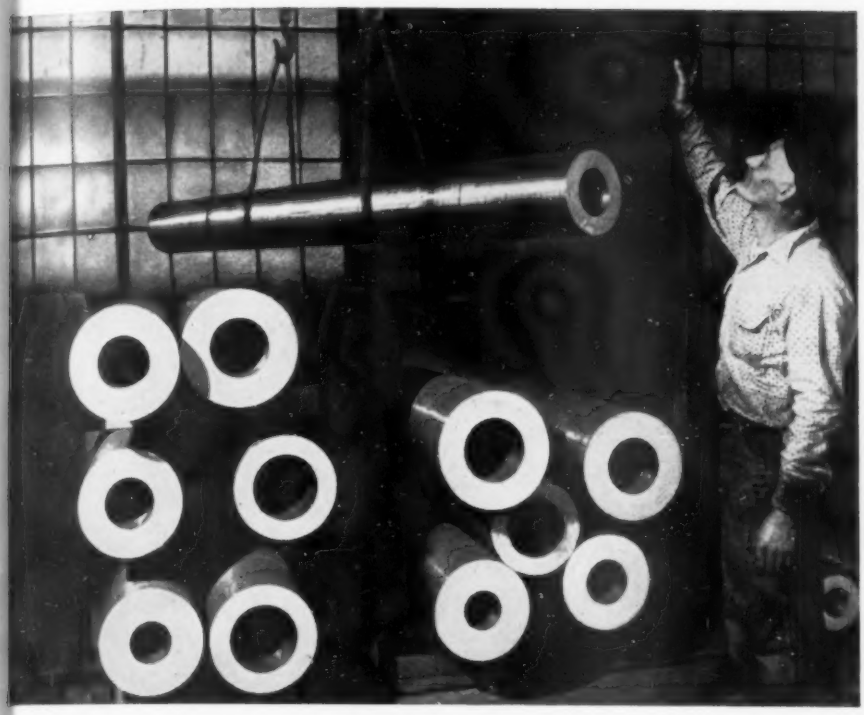
Tool Steel Topics



BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

West Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



New Tool Steel Saves Production Time

BTR HOLLOW-BAR IDEAL FOR ALL RING-TYPE APPLICATIONS

Making ring dies? Draw rings? Ring gages? Back-up rings? Then you'll want to use BTR Hollow-Bar, a new Bethlehem tool steel which is especially designed for this type of service.

BTR stands for "Bethlehem Tool Room," our popular oil-hardening tool steel. BTR Hollow-Bar is made by an improved Bethlehem process called High-Speed Trepanning. By this method, the center metal of the hammer-forged round bars is cored out and the bars are then rough-turned on the outside.

BTR Hollow-Bar saves production time and delivery time because your distributor can cut off rings from the bar to any desired length. It also enables you to save shop time, because there's no need to wait for forged rings or discs. What's more, in most instances there's no drilling, rough turning, rough boring, or rough-facing required.

BTR Hollow-Bar is furnished in the annealed condition to a Brinell of 202 max, and is smooth-machined on both the inside and outside surfaces. Stock lengths for small sizes are 6 ft to 8 ft, and for large sizes 8 ft to 12 ft.

Typical Analysis

Carbon	0.90	Chromium	0.50
Manganese	1.20	Tungsten	0.50
		Vanadium	0.20

If you'd like to know more about Hollow-Bar, talk it over with your distributor. Or write to us at Bethlehem, Pa.

66 HS MACHINES CAR WHEELS

Here the rim contour and front face of a "one-wear" wrought-steel freight-car wheel are being machined. The average depth of cut is 1/32 in. Both the roughing and finishing tools used in this machining operation are made of Bethlehem 66 HS. This is our moly-tungsten grade of high-speed tool steel. In addition to featuring wear- and shock-resistance, 66 HS also has good red-hardness.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

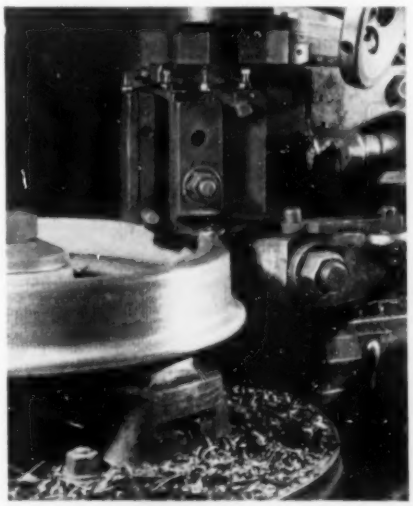
It Doesn't Pay to Punch All the Way Through

One of the best ways to improve the tool life of punches is to control the stroke of the punch. It is not necessary for a punch to go completely through the hole. When a punch does go through the hole, rapid wear occurs. This increases clearance, which in time increases the load necessary for punching, and results in burred edges.

When a punch has penetrated part way through the stock, "snapping" occurs and the "button pops out." The amount of penetration of punch before "snapping" takes place depends upon the material being punched, and the stock thickness. In general, the softer the material the greater the penetration required; conversely, a hard or brittle material requires less penetration.

The penetration on soft, thin stock may be as high as 90 pct of the stock thickness. On hard, thick stock it may be as low as 40 pct. The least amount of penetration which will bring out the "button" is best. What the penetration should be must be determined on each job.

Proper control of penetration of the punch by adjustment of the stroke of the press will pay off in decreased wear on the punch, resulting in better quality parts and increased tool life.



ASK **BAIRD** ABOUT IT!

HIGH PRODUCTION TOOLING

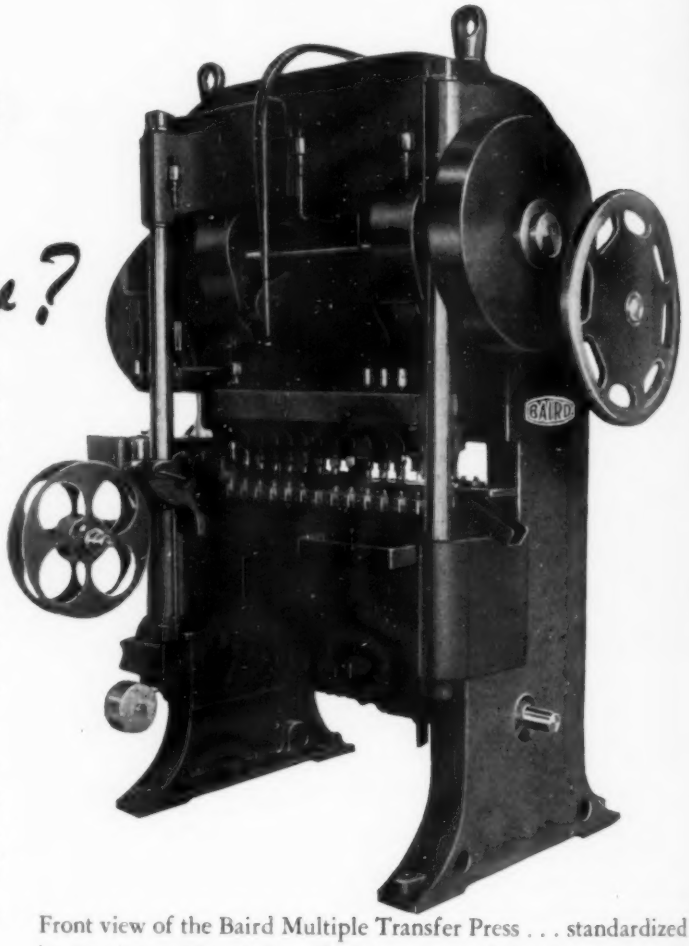
Biting off *More* than you can *Chew?*

Many types of small stamping machines can bite off coiled metal stock, but the BAIRD MULTIPLE TRANSFER PRESS cleverly chews each length into accurately formed products at the rate of thousands of pieces per hour.

Almost-human transfer fingers automatically grip and carry the work to progressive die stations where blanking, drawing, piercing, embossing, slitting, trimming, broaching, sizing, hexing, forming, etc., complete the piece.

Simply stated, the Transfer Press combines, in a single cycle, operations that otherwise might require several smaller machines with an operator for each. There are almost endless tooling possibilities . . . set-ups that turn out millions of small parts at extremely low cost.

An installation of Baird Multiple Transfer Presses puts the buyer in a most favorable competitive position in a buyer's market. Better "ask Baird about it!"



Front view of the Baird Multiple Transfer Press . . . standardized in 12 sizes with rated working pressures from 5 to 55 tons. Coiled stock from 2½" to 4" in width is automatically fed at high speeds.

SEND FOR TRANSFER PRESS BULLETIN

the **BAIRD MACHINE COMPANY**
STRATFORD • CONNECTICUT

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

A MODERN IDEA THAT SAVED MILLIONS!

The quick-change drill chuck was originated by Modern. It was and is one of the most outstanding contributions ever made to low-cost drilling ... an idea that has saved millions of dollars in drilling time!

Simple, strong and sturdy, Modern-Magic Chucks will do an outstanding job for you.

MODERN TOOL WORKS

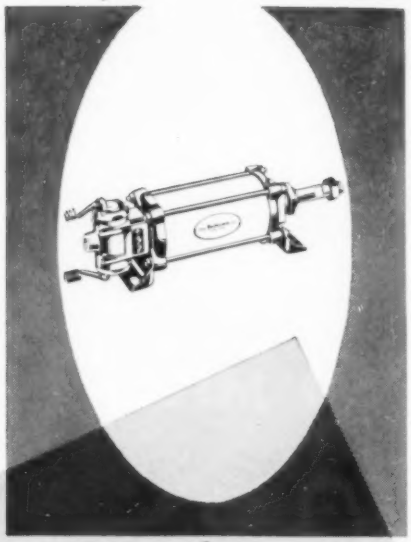
DIVISION

CONSOLIDATED MACHINE TOOL CORPORATION

WHOLLY OWNED SUBSIDIARY OF FARREL-BIRMINGHAM COMPANY, INCORPORATED

ROCHESTER, NEW YORK

Hydraulic control of air cylinder operation gives absolute smoothness of piston rod movement



Compressed air has "bounce" and "springiness," ideal for many operations. But this "bounce" and "springiness" of air can be troublesome when air cylinders are used to feed tools to work.

With the Bellows Hydro-Check you can combine the speed, economy and flexibility of air power with the smoothness of hydraulics. The Bellows Hydro-Check gives an air-powered piston rod unparalleled smoothness, completely free from chatter.

Using the Bellows Hydro-Check, with any air cylinder, you can advance the tool to the work at a high rate of speed, check the advance as the tool reaches the work, feed the tool through the work at the feed rate best suited for tool and material, and with rapid return of tool to starting position.

Result: Almost twice as many minutes actual machining time each hour; longer tool life through better control of feed rate; fewer rejects.

Write today for

BULLETIN HC-600R

"Hydraulic Control of Air Power"

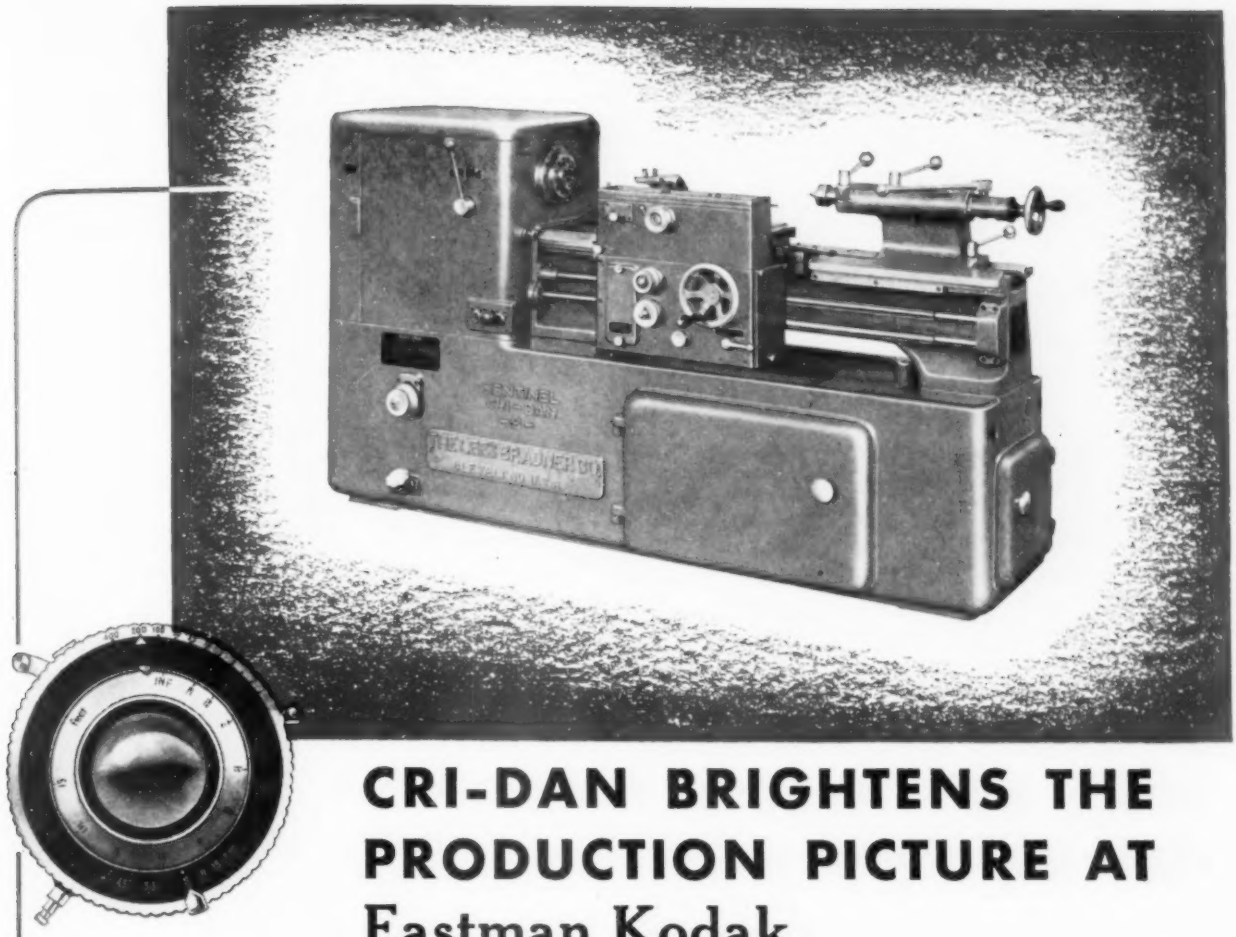
Dept. TE-754

The Bellows Co.

AKRON 9, OHIO

879-A

ROCHESTER, NEW YORK



CRI-DAN BRIGHTENS THE PRODUCTION PICTURE AT Eastman Kodak

Over a half-million lens mounts for Kodak cameras have been threaded on the Cri-Dan "B" during the past year. This fact, coupled with the extreme precision demanded in camera manufacture, dramatically proves that CRI-DAN Threading Machines combine accuracy and speed to an extent heretofore unknown.

Key to CRI-DAN's efficiency is the single carbide point tool which threads with unusual speed and accuracy. Changeover is fast and tool cost low.

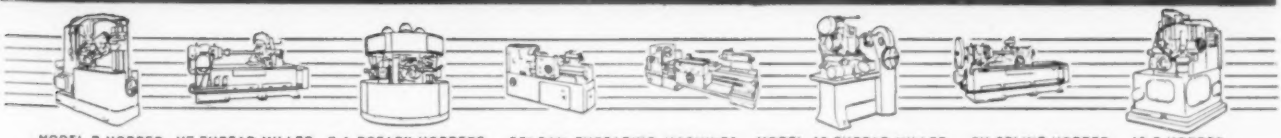
Take steps now to brighten your production picture. Get all the facts on CRI-DAN Threading Machines from your Lees-Bradner representative, or write direct.

CAPACITIES

Spindle Speed (In 24 Steps)	145 - 2800 RPM
Swing Over Saddle	4"
Swing Over Bed	13"
Capacity Between Centers	36"
Max. Thread Length	2½"
Max. Diameter Thread	4"
Rated Max. Capacity	10 TPI
Max. No. of Thread Starts	12
Max. Taper Thread	25° Incl.
Max. No. Passes Per Thread	32

the LEES-BRADNER Company

CLEVELAND 11, OHIO, U.S.A.



MODEL R HOBBER · HT THREAD MILLER · 7-A ROTARY HOBBERS · CRI-DAN THREADING MACHINES · MODEL 40 THREAD MILLER · SH SPLINE HOBBER · 12-S HOBBER

IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER

Story of a Reliefer that became the No. 1 Starter

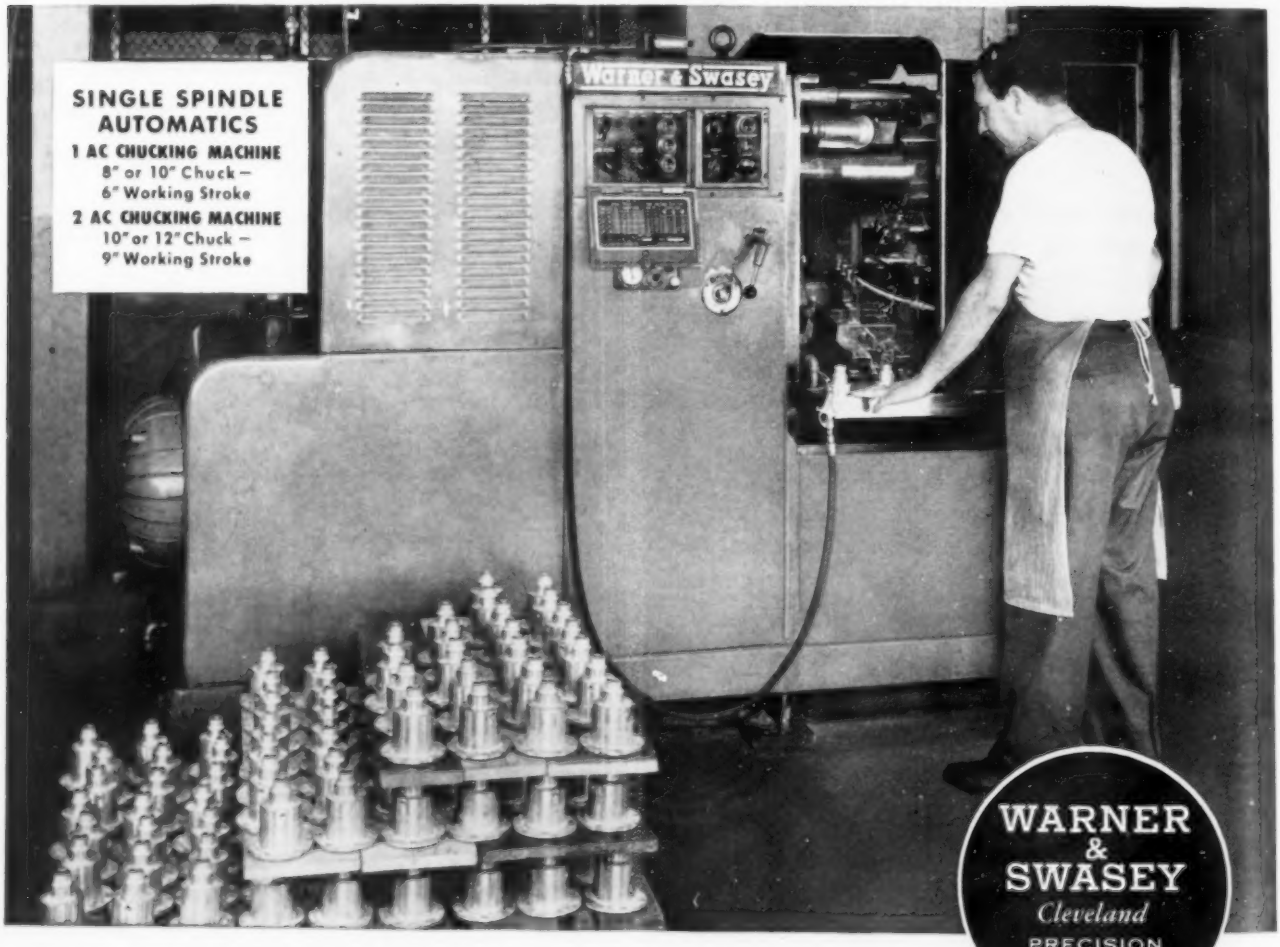
IT CAN HAPPEN with machines as well as men. Ask the Powers Regulator Company of Skokie, Ill.—manufacturer of automatic temperature and humidity control systems.

Powers Regulator, like many companies, was faced with the necessity of increasing production of a battery of turret lathes, some of which needed replacement. They also wanted to call in some of their subcontracted work. So they bought a Warner & Swasey 1 AC Single Spindle Automatic to help take the pressure off their hand-operated machines.

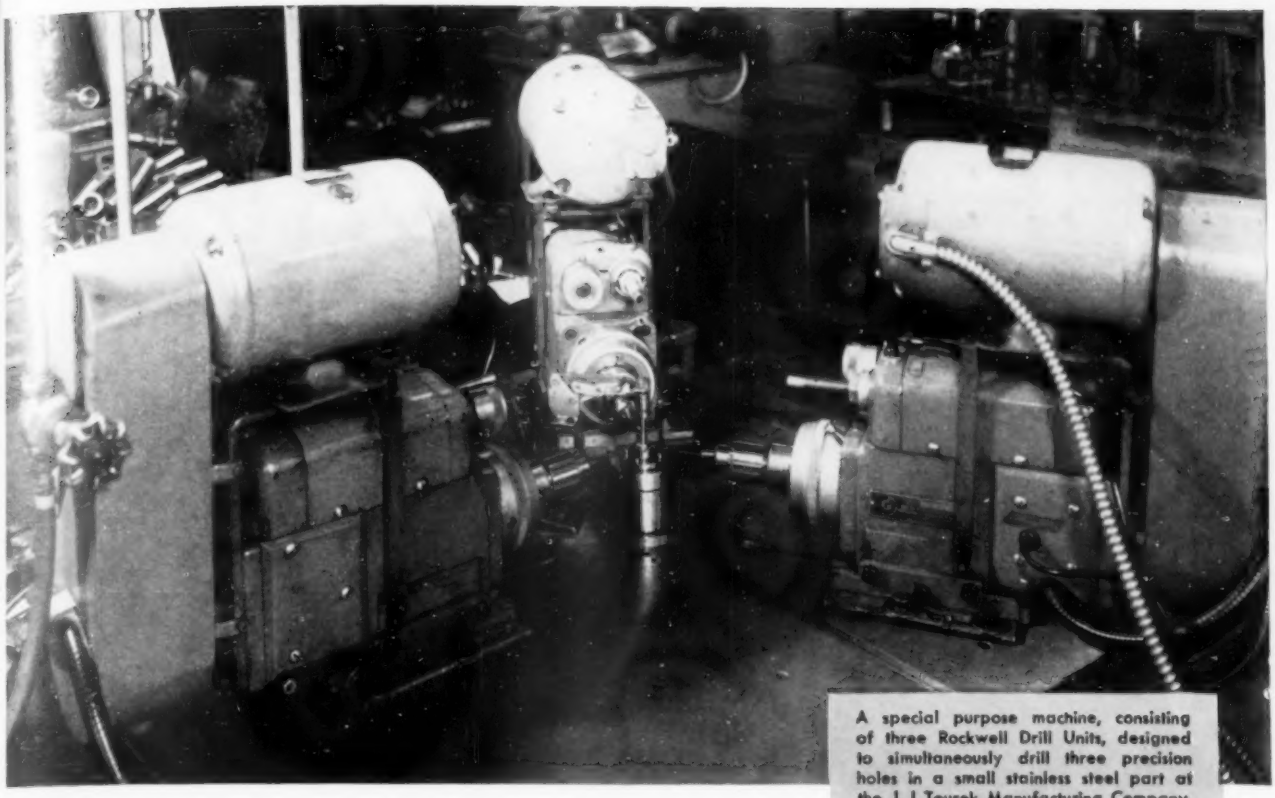
This company soon discovered that they had never fully realized the tremendous work potential of the 1 AC. It kept taking over more and more turret lathe work—increasing the production on some of the more complex pieces as much as three times. So the company scheduled the 1 AC for additional shifts—still more work.

The machine really did the job cut out for it! It eased the load on the turret lathes, and the company recovered work previously subcontracted. It performed so well, in fact, that Powers Regulator has since added a second 1 AC.

This story is not unusual. The 1 AC's quick setup and extreme accuracy make it ideal for increasing production on many turret lathe jobs—while requiring less skilled operators. And its advantages as an automatic cuts costs on short and long run jobs. But find out how the 1 AC will boost profits in your plant—call in our nearest Field Engineer for all the facts.



YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY



A special purpose machine, consisting of three Rockwell Drill Units, designed to simultaneously drill three precision holes in a small stainless steel part at the J. J. Tourek Manufacturing Company. The operation cuts parts cost 43%. Precision Rockwell Drill Units reduce time and motion in countless machining and assembly operations—can be mounted in any tooling arrangement.

J. J. Tourek Manufacturing Company
CUT PER PART COSTS 43%

with Rockwell* Air-Hydraulic Drill Units!

When production requirements at J. J. Tourek Manufacturing Co., Chicago, demanded a machine to drill small parts much faster than the single drill method, design engineer Donald Moeller developed a simple machine around Rockwell Air-Hydraulic Drill Units. It achieved the needed production and cut per part cost by 43% on the complete size range of stainless steel parts.

Says Mr. Moeller, "In the one year we've had our Rockwell Drill Units in two-shift production, their fast, reliable performance has exceeded our expectations. They've sped up production terrifically, reduced our costs and greatly increased drill life. Maintenance costs are so low we don't bother to record them."

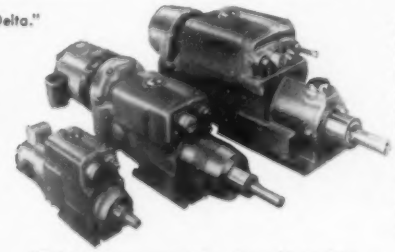
The Rockwell Drill Unit is a hydraulically controlled, precision packaged power unit that provides positive automatic control of length of rapid approach, feed, and depth. Singly or in multiples, it can be electrically interlocked with other units or mechanisms, and can be operated by unskilled personnel with a minimum of training. The Rockwell Drill Unit has proven time and time again that it can save big money in drilling, tapping, counter-boring, and kindred operations. *It can do it for you.*

Let your Authorized Sales Engineer discuss possibilities with you. He not only offers you engineering counsel, but can also demonstrate right in your plant. Send the coupon today for his name.

*Originally produced by Rockwell under the trade name "Delta."

Air-Hydraulic **DRILL UNITS**

Another Product by **Rockwell**



15 Drive Arrangements—from ⅓ to 5 hp.

Drill Unit Division, Rockwell Manufacturing Company
620G North Lexington Avenue, Pittsburgh, Penna.

☐ Please send name of nearest Authorized Sales Engineer.

☐ Please send me latest Drill Unit Catalog.

Name_____ Title_____

Company_____

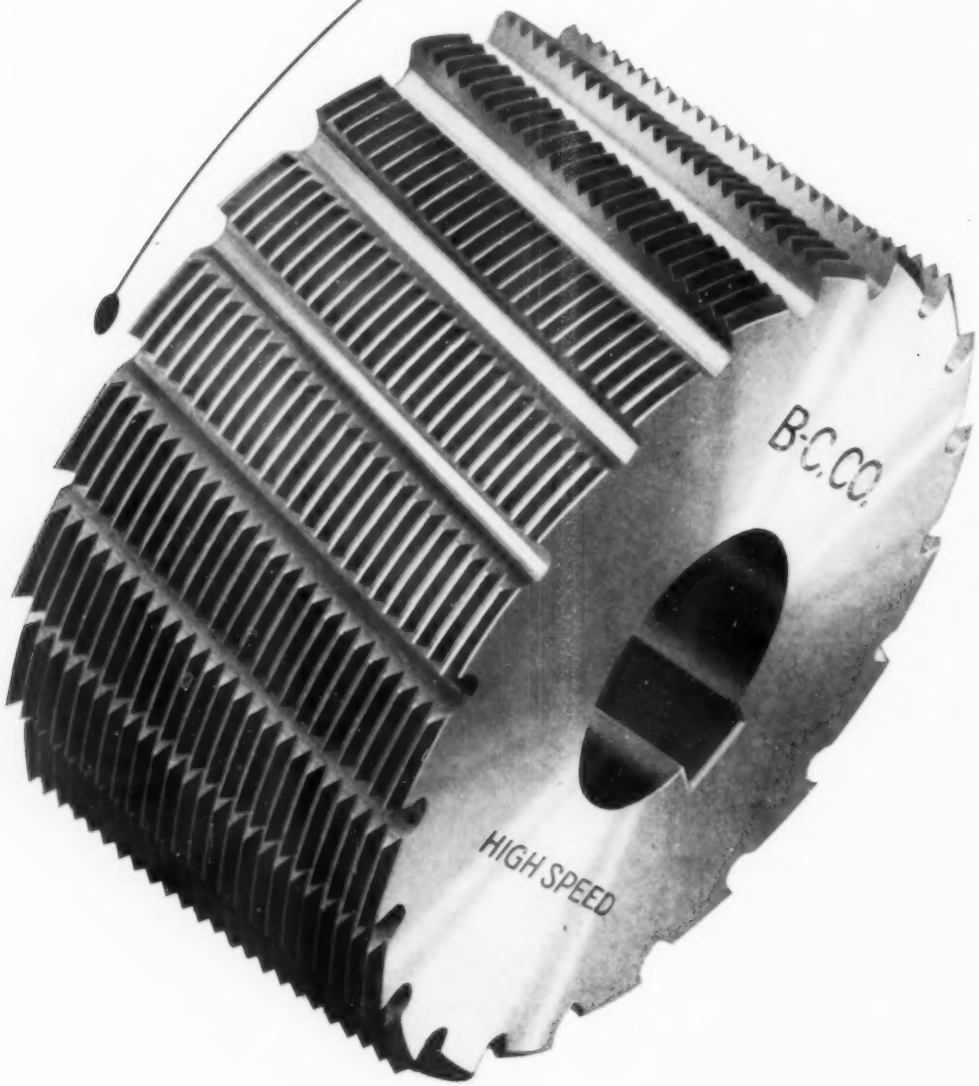
Address_____

City_____ County_____ State_____

Barber-Colman

THREAD MILLS

custom-built for high production, long cutting life, accurate threads



Thread accuracy and economical cutting life are synonomous with Barber-Colman Thread Mills because cutters which mill smoothly and easily, without premature dulling, also cut threads more accurately.

Barber-Colman cutter engineers have developed new manufacturing techniques for producing precision thread milling cutters with unground teeth, straight or helical flutes in either shell or shank styles, which give unusual tool life. The finest ground thread mills are also available from coarse to very fine pitches.

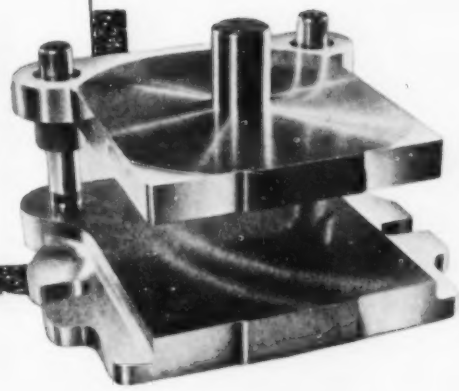
For special help in thread milling problems consult your Barber-Colman representative. He is a specialist on accuracy and milling of threads.

BARBER COLMAN®

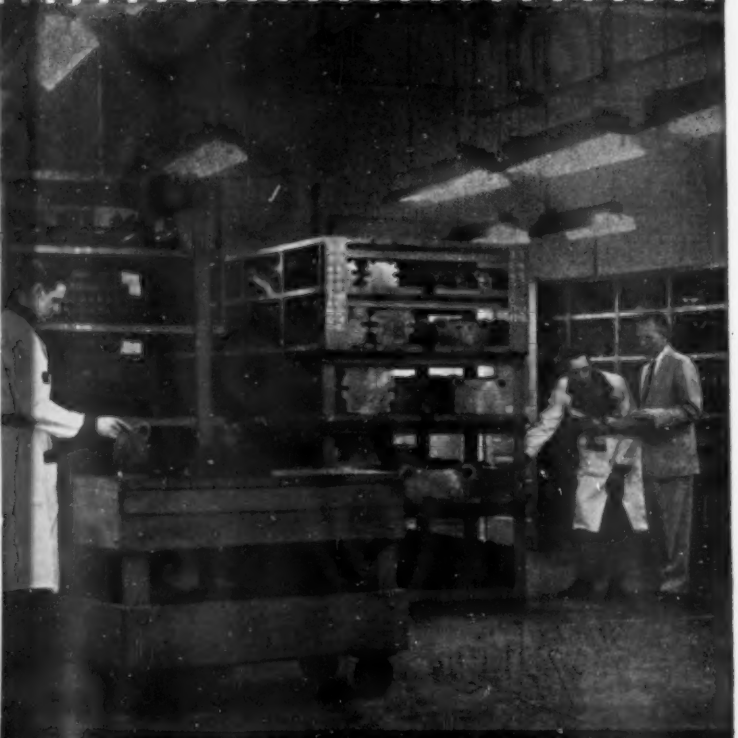
Barber-Colman Company

GENERAL OFFICES AND PLANT, 887 ROCK STREET, ROCKFORD, ILLINOIS

World's fastest die set service in action



Here's where faster die set service begins, on Danly's high speed precision production lines . . . the finest mass production facilities in the die set field.



Here's where your order is received . . . in one of Danly's Branch Plants. Because all die components are close at hand, your order is filled immediately.

Now—Danly unites mass production techniques with the precision touch of craftsmanship to bring you the fastest die set service . . . ever.

Never before has there been a die set service as fast as the one that Danly now offers to you. Unique in concept, the system had its beginning some years ago when Danly originated its network of nationwide Danly Branches. Under such a system the main Danly Plant in Chicago provided thousands of *interchangeable* die set parts to Danly Branch Plants. It meant that such parts were easily assembled into standard die sets and then quickly delivered to meet the requirements of any tooling program.
But, as buyers recognized the convenience of Danly service, demands on the Chicago Plant grew to exceed capacity. The solution? . . . an unprecedented move in the die set field. Danly put die set manufacture on a mass production basis with no sacrifice of famous Danly precision. It was accomplished with amazing new facilities in the form of two complete production lines devoted exclusively to high speed, precision die set production. The next time you put one or a dozen Danly Die Sets on order, expect to get fast delivery from any Danly Branch, expect to get die sets unequaled in precision. You can expect it and you'll get it . . . when it's Danly.

DANLY®

DIE SETS . . . STANDARD OR SPECIAL
DIEMAKERS' SUPPLIES

Fast, nationwide delivery from these plants

***CHICAGO** 50	2100 S. Laramie Avenue
***CLEVELAND** 14	1550 East 33rd Street
***DAYTON** 7	3196 Delphos Avenue
***DETROIT** 16	1549 Temple Avenue
***GRAND RAPIDS**	113 Michigan Street, N.W.
INDIANAPOLIS 4	5 West 10th Street
***LONG ISLAND CITY** 1	47-28 37th Street
***LOS ANGELES** 54	Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2	111 E. Wisconsin Avenue
***PHILADELPHIA** 40	511 W. Courtland Street
***ROCHESTER** 6	33 Rutter Street

**Indicates complete stock.*

TRIED and TESTED – AVAILABLE NOW!

New EZ machining LUDLUM TOOL STEELS

DBL2-EZ
VLM-EZ
LMW-EZ
HIGH SPEED STEELS

HURON-EZ
ONTARIO-EZ
DIE STEELS

"EZ" is a well-known symbol to users of Allegheny Ludlum products. We've been producing easy-machining stainless steel grades under that symbol for many years . . . they're a standard in the industry for improved machining characteristics.

This long experience, applied to the "EZ"-machining grades of the three High Speed and two Die Steels listed above, is your assurance of dependably uniform free-cutting qualities and improved finish—wherever such properties are desirable in your operations.

All five grades have been thoroughly proved and are readily available in the usual wide range of shapes and sizes. ● Write for literature on the grade(s) in which you are interested. *Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pennsylvania.*

ADDRESS TE-55

For complete MODERN Tooling, call

Allegheny Ludlum

WAD 5222

AL FINE TOOL STEELS SINCE 1854

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-7-170

Miller — HIGH PRESSURE HYDRAULIC CYLINDERS

ME PLATED
ON RODS
Scratch-Damage,
d Rust

SOLID STEEL HEADS, CAPS and MOUNTINGS
Eliminate Breakage

IRT WIPER SEALS
rotect Rods, Seals, Bushings

Standard Leather Cup Seal Assembly Shown Is Interchangeable With Miller Standard Piston Ring Piston Assembly

"Stock" Models For Immediate Delivery Added To Famous "Custom-Built" Line

Miller "Custom-Built" Cylinders are available on normal delivery in an *almost infinite selection.*

Identical-quality "Stock" Cylinders are available for *immediate delivery* in these *popular sizes . . .*

NON-CUSHIONED: 1½", 2½" and 4" bore sizes each available in 2", 4", 6", 8", and 11" strokes. CUSHIONED BOTH ENDS: 2" and 3¼" bore sizes each available in 3", 5", 7", 9", and 13" strokes.

"Stock" Cylinders are basic Model H5 with foot, flange and pivot mounting attachments available as desired.

NOTE: "Stock" Miller Air Cylinders also available!

Write for Complete Stock List

WRITE FOR CYLINDER BULLETINS H-104 and A-105

Complete Miller cylinder line includes: air cylinders, 1½" to 20" bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

MET J. I. C. HYDRAULIC STANDARDS years before their adoption in 1949.

SPACE-SAVING SQUARE DESIGN originated by Miller in 1945.

SALES AND SERVICE FROM COAST TO COAST

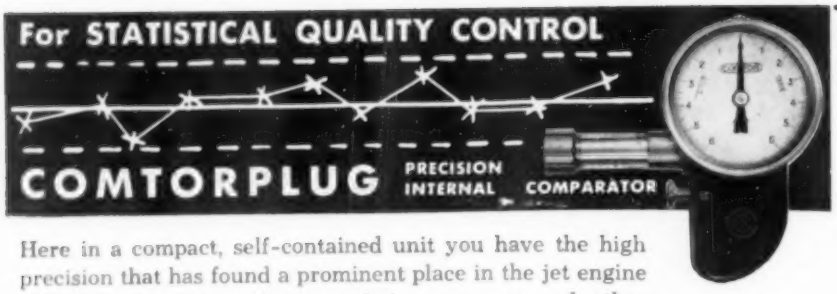
CLEVELAND • YOUNGSTOWN • DAYTON • PITTSBURGH • PHILADELPHIA • BOSTON • HARTFORD • NEW YORK CITY • BUFFALO • ST. PAUL • GRAND RAPIDS • DETROIT • FLINT • FORT WAYNE • SOUTH BEND • INDIANAPOLIS • MILWAUKEE • LOUISVILLE • KANSAS CITY • SEATTLE • LOS ANGELES • SAN FRANCISCO • BALTIMORE • DENVER • ST. LOUIS • MOLINE • CHICAGO • HOUSTON • TORONTO, CANADA and OTHER AREAS

Miller

MILLER FLUID POWER CO.
(Formerly MILLER MOTOR COMPANY)

2010 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATO



Here in a compact, self-contained unit you have the high precision that has found a prominent place in the jet engine program, the automatic transmission program and other fast moving set-ups. Used at machine or bench, Comtorplug has self-aligning features assuring accuracy. Ideal for Statistical Quality Control programs. Comtor Co., 69 Farwell St., Waltham 54, Mass.

Write for "Bulletin 48"

COMTORPLUG

With Interchangeable Expansion Plugs from ⅛" to 8" dia.

For gaging high-precision holes to fractions of .0001"

NEEDS NO WIRES, HOSE, ELECTRONIC GEAR OR HEAVY BASE

"Packaged Precision"

COMTOR COMPANY REPRESENTATIVES

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GERALD B. DUFF & COMPANY
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LOUIE A. GAIN
1544 Spruce Street
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F. D. HUNTINGTON CO.
9101 East Jefferson Ave.
Detroit 14, Michigan

WALTER R. OLT
306 Abingdon Road
Dayton 9, Ohio

HAROLD E. SUNDBERG
Ellicott Square
Buffalo 3, New York

CONANT BROACH COMPANY
347 West 107th Street
Chicago 28, Illinois

GERHART M. COOKE
4760 East Olympic Blvd.
Los Angeles 22, California

L. D. SUPPLY COMPANY
436 Maple Street
Wichita, Kansas

M. L. LEVIS
Fairview Park
4595 West 214th Street
Cleveland 26, Ohio

PROCTOR & MARTIN CO., INC.
297 Franklin Street
Boston, Mass.

SEVERANCE TOOLS OF CANADA, LTD.
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Toronto, Ontario, Canada

ENGINEERING SALES COMPANY
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Houston, Texas
and
1905 S. Harwood
Dallas, Texas

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-172-1

Wanted . . .

Machine tool designers

looking for real opportunity in

electrical circuit design and hydraulic control functions

In a rut where you are? Feel your progress is being blocked? Then why not give your talents a fresh start in a new, modern facility, working for an aggressive, highly respected organization, a leader in its field for over 50 years.

Here's the opportunity you've talked about. Now do something about it. The permanent expansion of our business demands qualified design engineers who can combine imagination and ability in the practical solution of machining problems (milling, drilling, boring, etc.)

There are 15 openings in this exceptional opportunity for advancement and for doing the things you like to do best — create and develop fine production machine tools. Excellent pay range commensurate with experience.

added benefits . . .

profit-sharing retirement benefits after two years service . . . liberal health insurance package . . . good labor relations . . . and located within the state that's the "Playground of the Middle West."

For full particulars write to BOX 700, THE TOOL ENGINEER, 10700 Puritan Avenue, Detroit 38, Michigan. Give name, age, marital status and summary of experience. We will correspond and interview if application is suitable. All communications held strictly confidential.

Precision Model

Standard Model

makes the Solid Arbor obsolete

CHAMPION
E-X-P-A-N-D-I-N-G
MANDRELS

The expanding sleeve, mounted on tapered arbor, expands automatically to fit the hole. Inserted by hand — no arbor press needed. Always an exact, positive, concentric fit. Locked by a single mallet blow. Unlocked the same way. CHAMPION Expanding Mandrels are used in machine shops around the world. Save time, cut production costs, whether the job calls for machining one piece or a thousand.

Precision Model has expansion range of .010". Available in regular sizes to fit holes from ½" to 3" diam. Holds work to tolerances of .0002" run-out. Guaranteed for precision grinding, turning and milling operations.

Standard Model maintains close tolerances, handles material of any length bore, hard or soft metals — from thin tubes and bushings to heavy castings and forgings. A set of fourteen will fit every hole from ½" to 9½" diam.

CHAMPION Expanding Mandrels can be made in special shapes and sizes to fit any specifications. Quotations on request. Write for descriptive folder today.

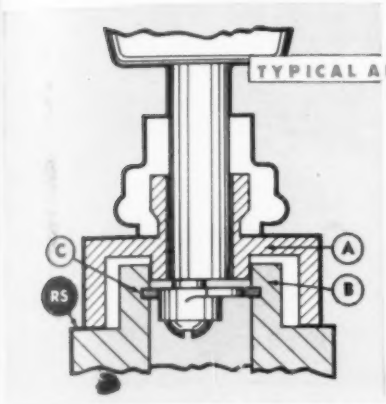
WESTERN TOOL & MFG. CO., INC.

Our 53rd Year • Dept. 23 • Springfield, Ohio

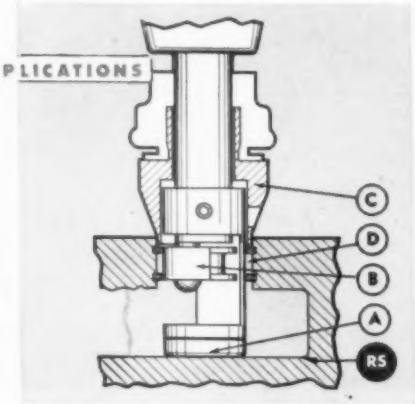
USE READER SERVICE CARD; INDICATE A-7-172-2

Waldes Truarc Grooving Tool Out-Performs Conventional Recessing Tools

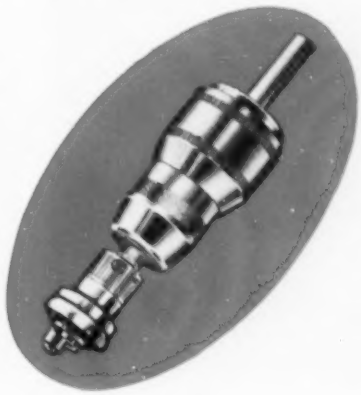
SAVES TIME! CUTS COSTS! NEEDS NO SKILLED LABOR!



Clearing Obstructions or Protrusions — Waldes Truarc Grooving Tool with *special bushing* with high shoulder A in order to clear obstruction B on reference surface RS so groove can be properly located in bore.



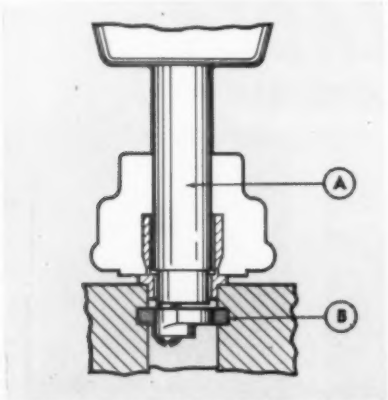
Locating Grooves from Bottom of Hole or Blind Hole—Use of *bottom adaptor* A and double cutter B. Bushing C pilots tool into bore D while bottom adaptor acts as stop to locate grooves from reference surfaces RS below bore.



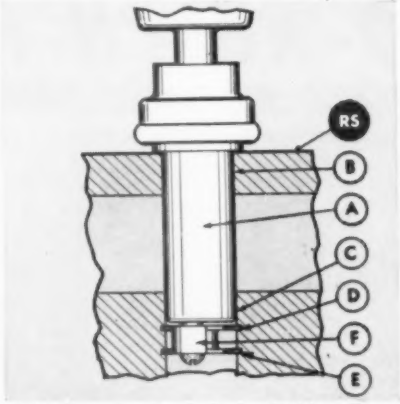
AMAZINGLY VERSATILE! The Waldes Truarc Grooving Tool adapts quickly and simply to your toughest recessing requirements. With it, even *unskilled labor* can perform and maintain high precision, mass production operations.

WIDE CUTTING RANGE! The Waldes Truarc Grooving Tool comes in five models: A-1, A-2, A-3, B and C. This wide variety of models enables you to cut accurate grooves in housings with diameters from .250 to 5.000 inches. Special features, modifications and adaptations allow each model to operate efficiently under many varying conditions.

SEND YOUR PROBLEM TO WALDES! Whatever your internal grooving problem, send us your blueprints and let Waldes Truarc engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job.



Small Diameter Bore — Need for Wide Groove — Great versatility of tools allows A-2 Tool to accept *stepped down spindle* and *cutter-shaft* assembly A. Provides cutting capacity in a bore normally within the range of smaller A-1 Tool. Illustrated, larger tool capacity necessary to cut groove diameter B exceeding normal capacity of standard A-1 Tool.



Extending Reach of Tool — Waldes Truarc Grooving Tool assembled with *extended bushing* A increases normal range of tool in order to reach proper groove location in bore. Bushing also registers on reference surface RS of workpiece while piloting tool at two points B and C inside bore. Two grooves D and E are cut simultaneously with double cutter F.

WRITE NOW FOR 20 PAGE TECHNICAL MANUAL CONTAINING FULL ENGINEERING DATA

WALDES TRUARC *Reg. U. S. Pat. Off.* **GROOVING TOOL**

MADE BY THE MANUFACTURERS OF WALDES TRUARC RETAINING RINGS.

WALDES KOHINOOR, INC., 47-16 Austel Pl., L.I.C.1, N.Y. Waldes Truarc Grooving Tool mfd. under U.S. Pat. 2,411,426

TE076

Waldes Kohinoor, Inc., 47-16 Austel Place
Long Island City 1, New York

Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool.

Name_____

Title_____

Company_____

Business Address_____

City_____ Zone___ State_____

KELLER pneumatic ratchet wrench

Under refrigerator coil housing

Under automobile accelerator pedal

Bolting automobile fender to cowl

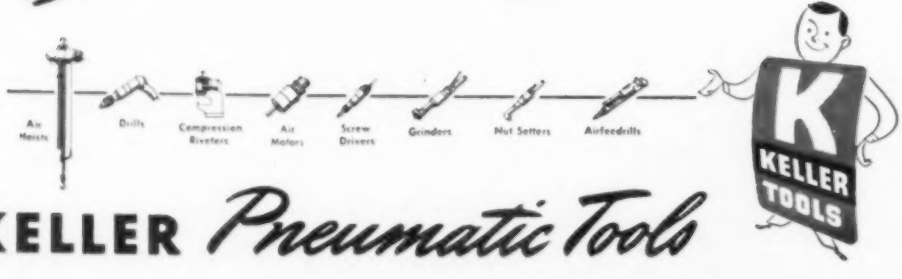
–the only power tool that can get into such HARD-TO-REACH PLACES!

Used in assembling deep-well turbine pumps

Fasten back splash to electric stove

Open end wrench attaches hydraulic tubing

Write for Literature... or *ask* your nearest Keller sales office



KELLER *Pneumatic Tools*

KELLER TOOL COMPANY
1311 Fulton Street
Grand Haven, Michigan

Now . . .

You can produce MORE for LESS with

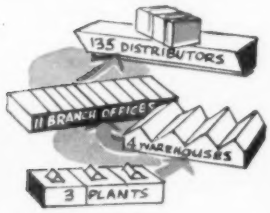
"ONE STOP" TOOLING SERVICE

Profit, today, must come from production . . . with overhead, sales, labor, and material costs at constant or increasing high levels. The need to produce more product for the same money or the same volume of product for less money makes *tooling* the *key* to profit!

Only Firth Sterling can serve you so completely in solving the tooling problems that enable you to make production profits . . . for these six convincing reasons:

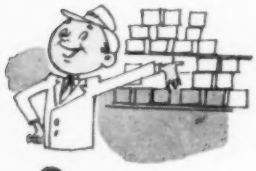
UNBIASED RECOMMENDATIONS Because Firth Sterling makes *both* steel and carbide tooling materials, you get completely unbiased recommendations. The exactly right tools or tooling materials will be matched to your production needs, resulting in better, faster, cheaper production.

UNLIMITED SELECTION *Only* Firth Sterling offers so many grades, styles and sizes of both steels and carbides from *one* source of supply . . . 16 High Speed Steels, 53 Tool and Die Steels, 6 High Temperature Alloys, 12 Tungsten Carbides embracing standard tools and tips, toolholders and inserts, dies, perforators, and "specials" *plus* Chromium Carbides, Stainless Specialties, Titanium Carbide Cermets, Firth Heavy Metal, and Zirconium!



EFFECTIVE NATIONAL DISTRIBUTION Three plants, 4 warehouses, 11 branch offices and 135 distributors strategically located in the manufacturing centers of the country assure readily accessible supply sources for all your tooling needs.

CONSTANT RESEARCH Continuing full-scale research with emphasis on product improvement, specialty steels, carbides, new metals and new methods assures you years-ahead tooling procedures when you make Firth Sterling your one-stop source of supply.



PACKAGED TOOL LINE The most complete line of packaged tools available comes in standard quantities, easy to handle, stock, identify and inventory . . . in both steel and carbide.

ONE SOURCE MAKES SENSE Yes, only Firth Sterling can so adequately provide one-stop, one-source-of-supply tooling service with its assurance of unbiased recommendations, simplified lower-cost ordering . . . resulting in better, faster, cheaper production. It makes sense, doesn't it? Ask Firth Sterling to analyze your tooling problems . . . to produce *more* for *less.*

Firth Sterling

—INC—

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

OFFICES AND WAREHOUSES*: BIRMINGHAM CHICAGO* CLEVELAND DAYTON DETROIT* HARTFORD* HOUSTON LOS ANGELES* NEW YORK PHILADELPHIA PITTSBURGH WASHINGTON WESTFIELD, N.J.

R-297

PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool and Die Steels
Stainless Specialties
High Temperature Alloys
Zirconium
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets

How TO AVOID Oversize and Bell-Mouthed Holes

Types to fit any machine used for tapping or reaming.

On tapping and reaming jobs there is an easy way to avoid oversize and bell-mouthed holes caused by faulty alignment of the work with the spindle.

In spite of inaccurate set-up, work can still be turned out to the finest tolerances if, instead of using an ordinary tool holder, you use a Ziegler Floating Holder which automatically compensates for spindle misalignment of as much as 1/32" radius or 1/16" diameter.

Instead of writing off spoilage losses day after day on tapping and reaming jobs, why not put an end to them by changing over to Ziegler Floating Holders? You'll find that they'll repay their cost in a remarkably short time.

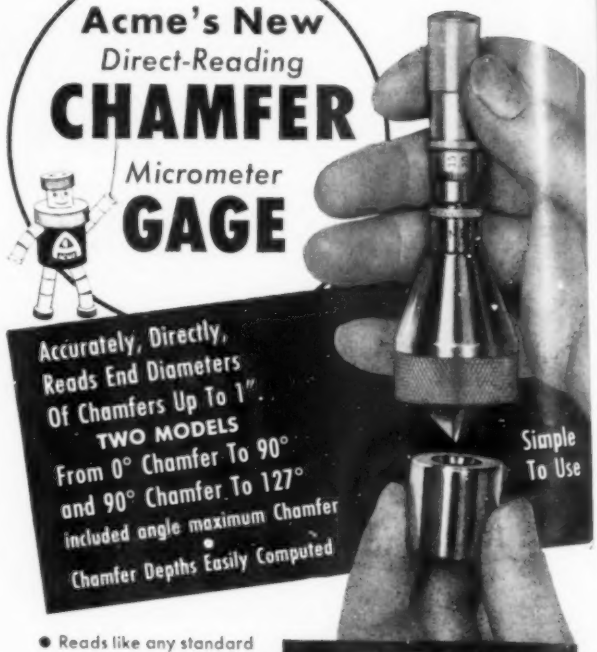
W. M. ZIEGLER TOOL COMPANY
13574 AUBURN DETROIT 23, MICH.

WRITE FOR CATALOG

Ziegler ROLLER DRIVE **FLOATING HOLDER** for Taps and Reamers...

USE READER SERVICE CARD; INDICATE A-7-176-1

Acme's New Direct-Reading CHAMFER Micrometer GAGE



Accurately, Directly, Reads End Diameters Of Chamfers Up To 1".
TWO MODELS
From 0° Chamfer To 90°
and 90° Chamfer To 127°
included angle maximum Chamfer
• Chamfer Depths Easily Computed

Simple To Use

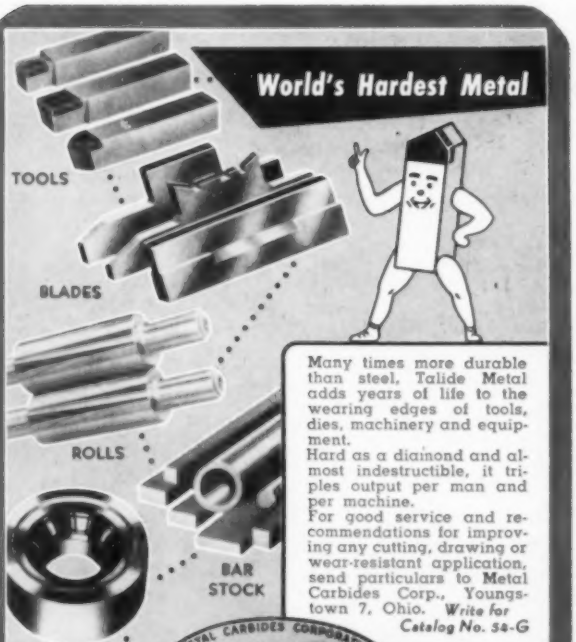
● Reads like any standard depth micrometer. Precision made for close tolerance work. Saves time, reduces error, reduces rejects. Quickly pays for itself. Send for details.

ACME INDUSTRIAL COMPANY
208 N. LAFLIN ST., CHICAGO 7, ILL.

MFRS. OF STANDARDIZED DRILL JIG AND FIXTURE BUSHINGS

USE READER SERVICE CARD; INDICATE A-7-176-3

World's Hardest Metal



Many times more durable than steel, Talide Metal adds years of life to the wearing edges of tools, dies, machinery and equipment.
Hard as a diamond and almost indestructible, it triples output per man and per machine.
For good service and recommendations for improving any cutting, drawing or wear-resistant application, send particulars to Metal Carbides Corp., Youngstown 7, Ohio. *Write for Catalog No. 54-G*

METAL CARBIDES CORPORATION
TALIDE
YOUNGSTOWN 7, OHIO
SINTERED CARBIDES · HOT PRESSED CARBIDES
HEAVY METAL · CERMETS · HIGH TEMPERATURE ALLOYS
OVER 35 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

USE READER SERVICE CARD; INDICATE A-7-176-2

DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2303D North 11th St. • St. Louis 6, Mo.

USE READER SERVICE CARD; INDICATE A-7-176-4

KEYLESS DRILL CHUCKS

SLIP-PROOF
STRONGEST CHUCK MADE
TRY ONE

K. O. LEE CO.
ABERDEEN, S. D.

If it's made by **Lee** *it's a* **"Knock-Out"**

USE READER SERVICE CARD; INDICATE A-7-176-5

reduce that part cost . . .

BROACH IT the *American* way

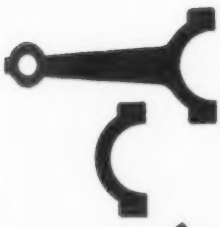
Broaching is a metal-cutting process that will remove stock to precision limits faster than any other metal-cutting process known — and will maintain those precision limits throughout production runs.

Below are a few jobs that have been done with American broaching tools and machines.

Broach and burnish round holes in refrigerator hub parts.

Broach splines and hole in automobile bevel gear.

Broach seven external slots in pump rotor part.



Broach jig pads and bolt seats on automotive connecting rods and caps.

Broach involute teeth and cam surface of gear part.

Regardless of how simple or complex your broaching application may be, American can furnish you broaching tools to meet your requirements in part tolerance and finish.

In addition to making all types of broaching tools, American builds broaching machines and fixtures, giving you a well-rounded manufacturing service. American backs up its products with a strong service organization that makes certain broaches, fixtures and machines installed by American will do the job for you.

So why not let American help solve your machining problems. Just send a part print or sample for a free estimate.

Write for Catalog 450. It describes American broaches, machines and fixtures.

AMERICAN

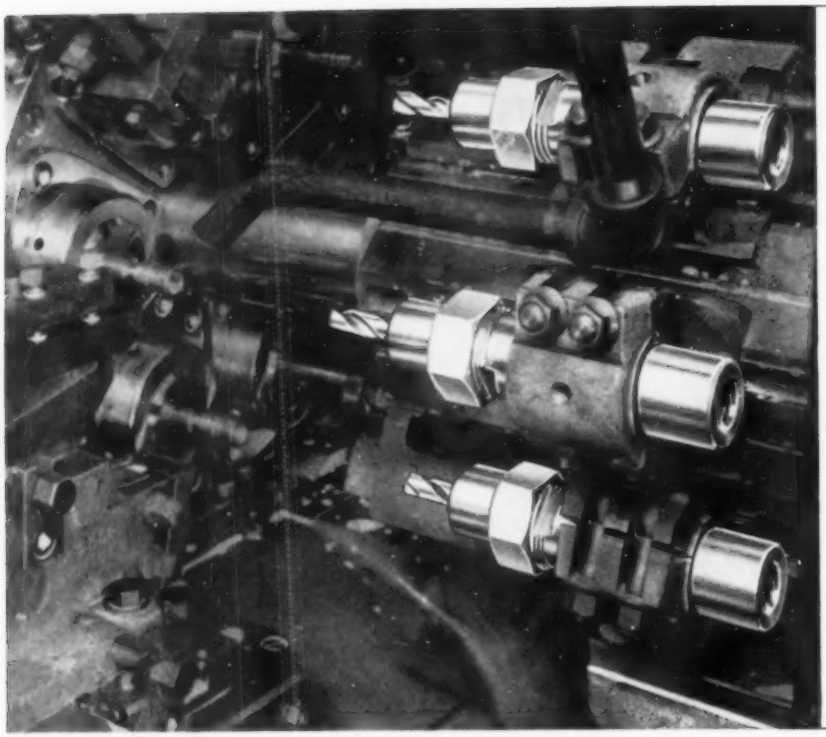
American BROACH & MACHINE CO.

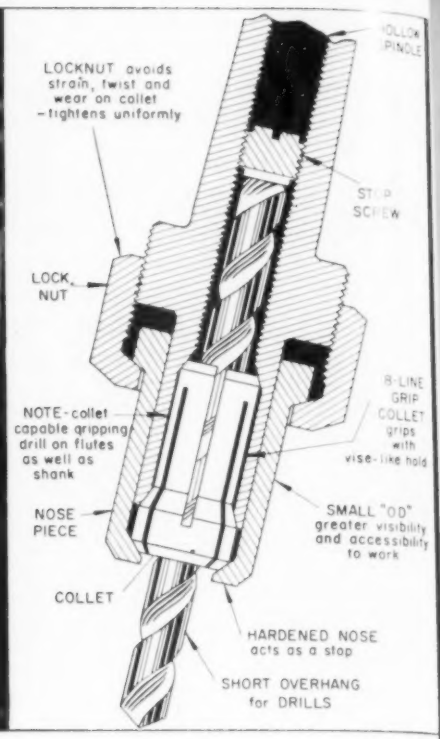
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery




LOCKNUT avoids strain, twist and wear on collet – tightens uniformly
LOCK NUT
NOTE - collet capable gripping drill on flutes as well as shank
NOSE PIECE
COLLET
HARDENED NOSE acts as a stop
SHORT OVERHANG for DRILLS
B-LINE GRIP COLLET grips with vise-like hold
SMALL "OD" greater visibility and accessibility to work

Precision or Quantity Runs

Cost Less when you use Erickson chucks!

After all, these precisely machined chucks are scientifically designed to extend machine accuracy right down to the very end of the tool. No other chuck can guarantee equal accuracy. With Erickson accuracy you frequently reduce the number of operations.

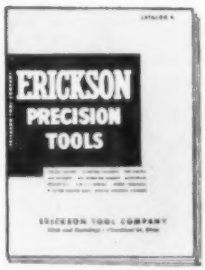
Guaranteed accuracy of .0005" and superior gripping power of Erickson collet chucks assure proper drill alignment. Drills then cut evenly on both cutting lips permitting faster machine feeds and proper speeds . . . give more holes per grind.

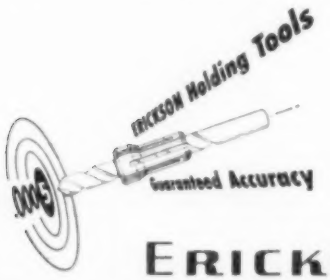
Production run records prove that Erickson chucks repay your investment in less than a month, often in the first week of operation. That's why we can confidently state that *Erickson chucks actually cost you far less!*

Here's why!

1. More holes per grind.
2. Guaranteed accuracy of .0005".
3. Collet collapses over a range of $\frac{1}{32}$" replacing seven standard single purpose collets.
4. Grips drills on flutes permitting stubbing and use of broken drills.
5. Permits greater feeds and speeds.
6. Gives better tool performance and extends tool life.
7. Reduces set-up time.
8. Tighter grip with even pressure along entire length of collet.

REDUCED TOOL COST, FASTER OPERATION and GREATER ACCURACY mean lower production costs for you. Send for your copy of our new Catalog K today! You'll find many interesting applications for all Erickson holding tools. Let an Erickson field engineer show you actual case histories. A-9548





ERICKSON TOOL COMPANY

2303 Hamilton Avenue • Cleveland 14, Ohio

COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • SPECIAL HOLDING FIXTURES

Which is the CleCap?

...all of them

—ready for fast delivery on time!

If it's a cap screw, CleCap makes it. Whatever head style or size you want, whether you want ferrous or non-ferrous. You can get CleCap top-quality fasteners, on time, one or a million!

We're *The* cap screw specialists—that's why thousands of our customers stick to CleCap year after year. They can't beat the quality—and they know by happy experience that their friends at CleCap gladly knock themselves out to get them what they want when they want it.

That can be pretty important to you. Who pays when late deliveries shut down your production? . . . No fooling—it pays you to order your requirements from CleCap. You'll like the service you get.

CLEVELAND *Top Quality* FASTENERS

Ferrous and Non-Ferrous

Hex Head Cap Screws—Bright and High Carbon Heat Treated Steel, Brass, Silicon Bronze, Stainless Steel: ¼" to 2½" dia.
Socket Head Cap and Set Screws—Plain and Knurled: ¼" to 1½" dia. Also flat and Button Head Styles
Flat Head Cap Screws: ¼" to 1" dia.
Fillister Head: ¼" to 1¼" dia.
Set Screws—Square Head: ¼" to 1½" dia.
Milled Studs: ¼" to 1¼" dia.
Place Bolts: ¼" to 1⅛"
Structural Bolts
Tractor Bolts
Special Hot and Cold Headed Parts

Facilities to make larger diameters than listed.

Ask Your Jobber for CleCap!

The Cleveland Cap Screw Company

2944 East 79th Street • Cleveland 4, Ohio • VUlcan 3-3700 TWX CV42

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Originators of the Kaufman DOUBLE EXTRUSION Process

Don't throw away that back-up pad!

Just replace the leather! It's the new Armour Back-Up Pad with re-usable plates!

Are you throwing away your back-up assemblies – metal parts and all – when just the pad wears out? You can save that expense with the new Armour Back-Up Pad. It's designed so you can detach the steel plates and use them over and over again! The pad will last longer, too, because it's a two-ply construction of the finest leathers, tanned and curried for resistance. And when the leather finally does wear down, you can save money by cutting the Armour pad into a smaller size – it's as good as new!

Another money-saving feature of the new Armour Back-Up Pad is that it's tailored at the factory to save you "breaking in" time. You can even order the flexibility you want – hard, medium or soft! And to guarantee perfect flexibility, your Armour Back-Up Pad receives four precision-balance tests at high speeds. So you can be sure that your pad absorbs shock, cuts down vibration and provides the disc with smooth, safe sanding action. Let your workmen test this precision-balance pad once – and they'll request Armour Back-Up Pads always for higher production and less operating fatigue!

Use these new pads with Armour Resin Fibre Discs!

Actual production tests have proved that resin-bond discs have two big advantages over glue-bond products – resistance to heat and resistance to moisture. So save money in severe grinding operations and edge-wear grinding jobs – choose Armour Resin Fibre Discs! And for belts, rolls, sheets, any abrasive you need, call on Armour today!

Learn more about Armour's Precision Abrasives!

ARMOUR AND COMPANY,
North Benton Road, Alliance, Ohio

Please send me free booklets on:

☐ Armour Back-Up Pads ☐ Storing Abrasives ☐ The Back-stand Belt Method

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Years of successful experience in special tooling and related production problems are yours for the asking. When the job requires special cutting tools call in your National Tool Co. representative. He is backed by more than 49 years experience in the engineering and manufacture of special cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

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Since 1905 engineers and manufacturers of high-quality special cutting tools for the metal-working industry

NATIONAL Tools CLEVELAND

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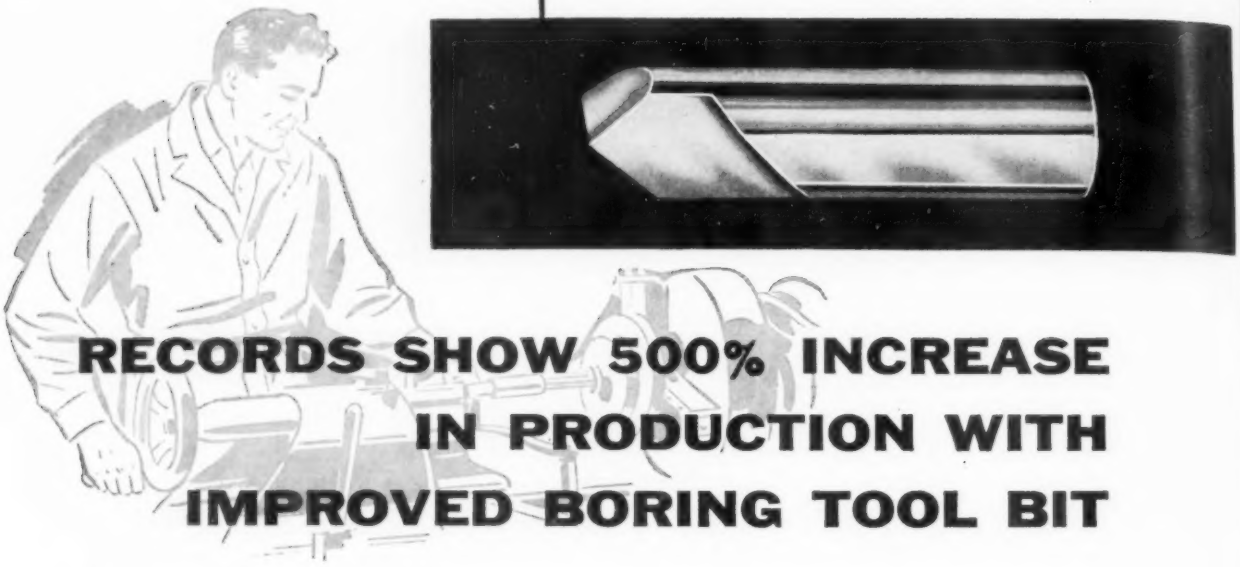
ATRAX IN ACTION



RECORDS SHOW 500% INCREASE IN PRODUCTION WITH IMPROVED BORING TOOL BIT

A CASE HISTORY: One of our customers had experienced considerable difficulties in boring tapered holes in stainless steel. The specifications called for extremely close diameter and taper tolerances, and a finish requirement of ten micro-inch. The carbide tool previously used gave the customer a production of one piece part, containing eight holes, per eight-hour day. With the new Atrax superior finish ground boring bit, production increased to about five piece parts per day. One tool bit roughed out and finished eight holes before resharpening was necessary, and the finished product was eight micro-inch or better. Atrax Solid Carbide Tool Bits improved production in this instance by over 500%

Possibly our engineers or sales representatives can help YOU achieve similar savings. You'll find them in all principal cities, ready to consult without any obligation.

NEW! Complete 88-page Manual and Catalog of Carbide Tools. Write for your free copy.

THE ATRAX COMPANY NEWINGTON 11, CONNECTICUT

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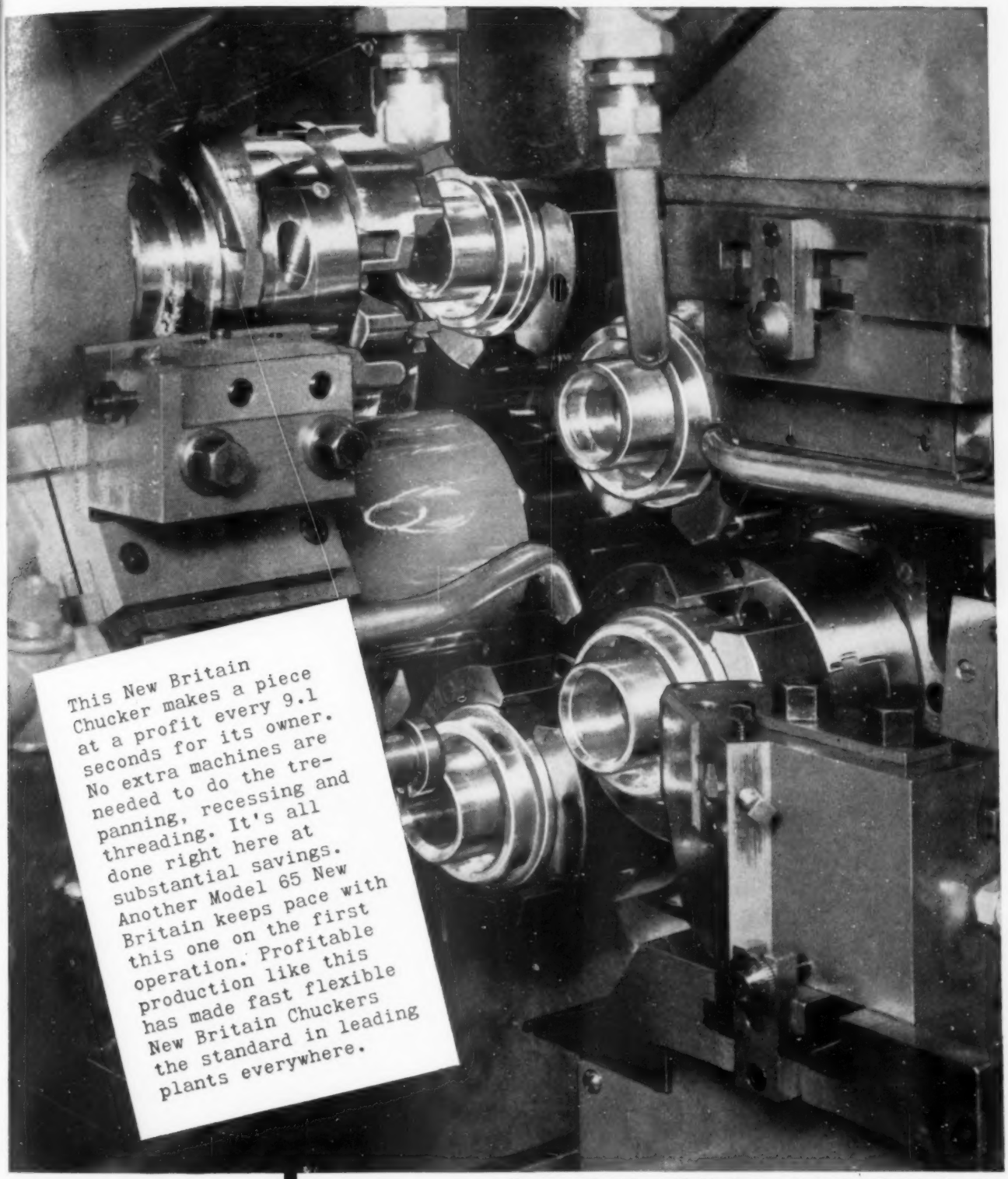
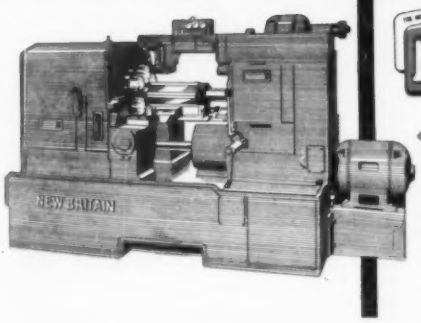

This New Britain Chucker makes a piece at a profit every 9.1 seconds for its owner. No extra machines are needed to do the trepanning, recessing and threading. It's all done right here at substantial savings. Another Model 65 New Britain keeps pace with this one on the first operation. Profitable production like this has made fast flexible New Britain Chuckers the standard in leading plants everywhere.

Our general catalog is filed in the Sweet's Machine Tool Catalog File.



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HIGH SPEED—CARBIDE TIPPED

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Standard interchangeable counterbores carried in stock for immediate shipment, in both high-speed and carbide-tipped.

Specials designed and made to order on short notice.

Your first order will demonstrate the merits.

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Taper.
Interchangeable.
Never freezes.
Double pin
powerful drive.
Rigid.
Centralizes tool.
Accurate and
dependable.

We have sales representatives in all principal industrial areas. Write to us for catalog No. 53 and the name of our agent.

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WESSON Engineering Skill *Improves*

The World's Most Perfect TOOL HOLDER . . .

NOW

WESSON MULTICUT

BAND TYPE

TOOL HOLDERS HAVE

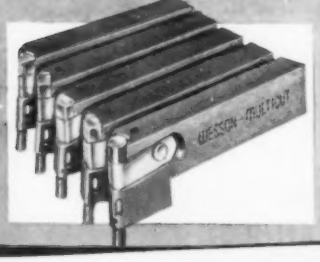
A BUILT IN, FOOLPROOF CARBIDE FLUSH GAGE!

The carbide flush gage is precision ground for fooolproof accuracy. Any operator can reset the insert quickly and with positive accuracy.

NEW . . . The elliptical slot makes removal of the insert simple and easy.

CHECK THESE ADVANTAGES . . .

- √ Rapid, accurate set up reduces downtime.
- √ Foolproof adjustment of insert.
- √ Gage is permanent part of holder.
- √ Eliminates height gages, rules, etc., ordinarily required.
- √ Elliptical slot permits fast removal of insert.
- √ All this on the superior Multicut Holder at NO EXTRA COST!



Over 101 standard sizes— 11 Styles available from stock!

Wesson's Multicut band type holders, long famous as the industry's most efficient tool holder, now offers you these new unique features to save you time and money.

The "built-in" solid Wessonmetal flush gage, a permanent part of the holder, provides positive accuracy and reduces set up time. The addition of the elliptical slot permits the operator to remove the insert in a split second even when the insert is "baked in" by mixtures of coolant and metal powder due to the heat generated by severe cutting operations. These fectures, plus the replaceable band, assure you the best possible efficiency in the Multicut Holder. Call the Wessonman in your area for complete details.

THE WESSON MAN *in your area has many case histories proving the high performance rates of Wesson Tools and Wessonmetal. Call him today.*

WESSON COMPANY

1220 WOODWARD HEIGHTS BLVD.
FERNDALE (DETROIT 20), MICHIGAN

this low-cost carbide-tipped reamer that holds precision tolerances in mass production!

Exceptional tool savings are made possible by this Staples Carbide-Tipped Shell Type Expansion Reamer (patented). These savings are fully realized in the plant of a leading midwest truck engine manufacturer. When the carbide-tipped shell has worn to the tolerance limit, it is quickly, accurately expanded to original diameter by driving the shell up the tapered arbor.

In the application cited at left, the tool shown above reamed 3591 cylinder blocks before requiring sharpening. The tool was resharpened 16 times and expanded as required to hold tolerance, before it was worn undersize. Note the hole finish obtained. The tool was then returned to new condition simply by replacing only the shell—an inexpensive stock item. Where hole tolerances are not as close and finish requirements not as critical, the number of pieces reamed before expansion would greatly increase.

If you are seeking relief from high tool costs on a precision, mass-production reaming job, this Staples Reamer is your answer! Staples engineers will gladly work with you on the application. Your inquiry will bring a prompt response.

3591 CYLINDER BLOCKS REAMED PER SHARPENING—TOOL RESHARPENED 16 TIMES

JOB DATA:

Machine	Multiple spindle drill station in automatic transfer machine
Work	Finish ream tappet bores in cast iron cylinder blocks
Hole Diameter	1"
Hole Depth	2"
Stock Removal	0.015"
Tolerance Held	+.0002" —.0002"
Finish Specified	40 RMS minimum
Finish Obtained	10 to 20 RMS
Spindle Speed	416 RPM
Feed Rate	.0149" per Rev.

Staples CARBIDE-TIPPED CUTTING TOOLS

A complete line of Circular Carbide-Tipped Tools, Expansion Reamers—Special Tools

THE STAPLES TOOL COMPANY, Cincinnati 25, Ohio

GEARS NOISY? ...Of Course

The Gear Business has always seemed to attract colorful and positive characters. Like George B. Grant, the Dean of Gear Makers in the Gay Nineties.

Sixty years ago he gave industry a few gems of philosophy in what he referred to as his Treatise on Gears.

For Instance:

"**Noise:** at a high speed is unavoidable. Fibre gears are quieter and softer than metal, and raw-hide is still quieter and less durable. Raw-hide and fibre are good at high speed, but unsuitable for heavy strains.

I Am Not Responsible for Any Mistake: even if I make it myself, if it could have been prevented by sending me working drawings or good sketches. If you make me guess, you must take the responsibility. A poor drawing is better than none.

Unless Otherwise Described: every gear ordered is a cut spur gear of cast iron, and it will have such diameter, pitch, face, hole, hub, and quality as I happen to think most desirable. Describe what you want and that you will get, but if you omit any detail I may write to you for the information required or I may guess at it and go ahead.

A Fit: is guaranteed only when I have the parts to be fitted. I ream a hole with a one inch reamer, for example, but do not guarantee that it will fit your one inch shaft.

Estimates: As a rule nothing is saved by getting an estimate. A low price means a cheap piece of work, here or elsewhere.

Steel Castings: are generally full of blow holes, and it takes a long time to get them. A cast iron gear of wider face is as strong and cheaper."

If Mr. Grant could only have run a sound test on RED RING Shaved Gears.

6778

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WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

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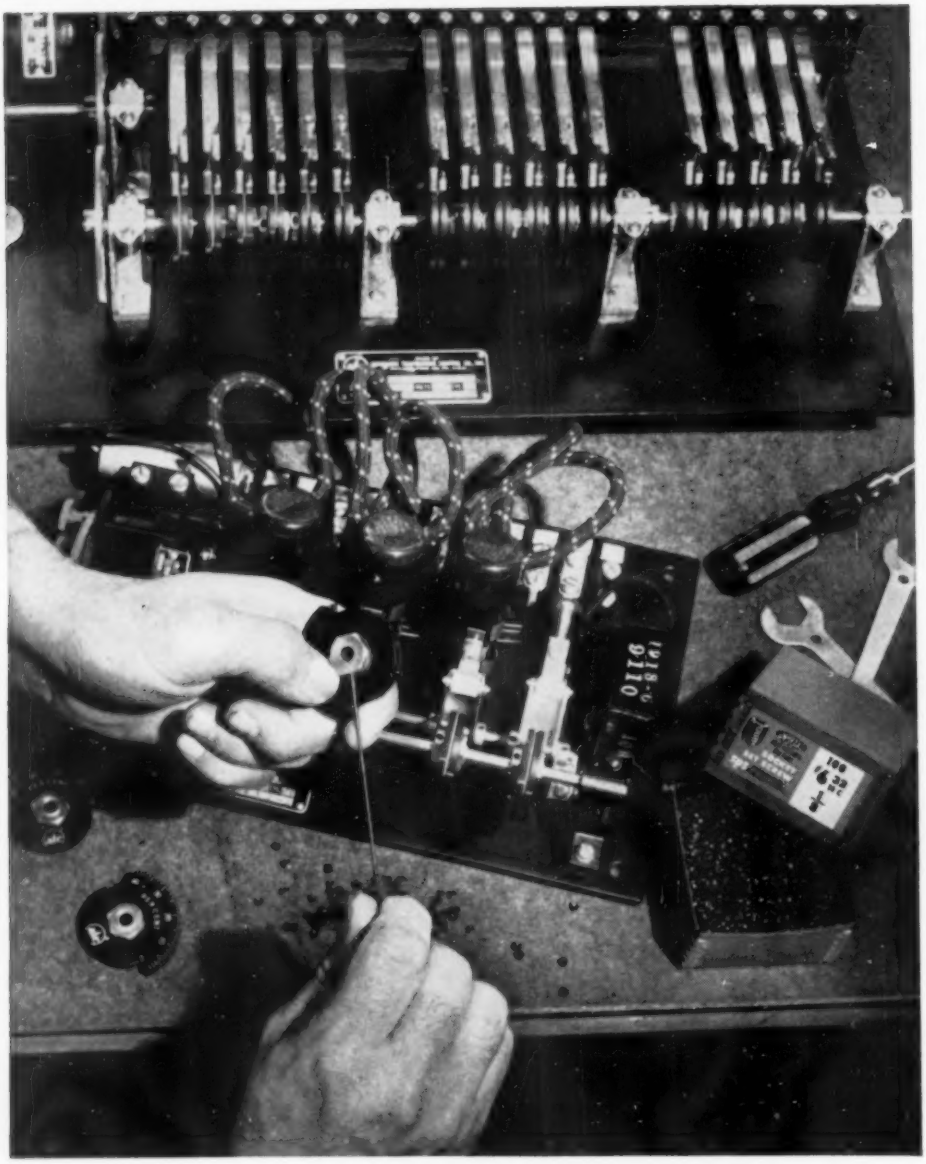
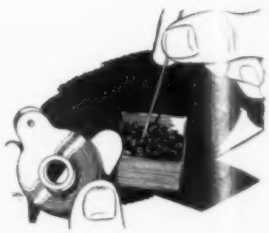
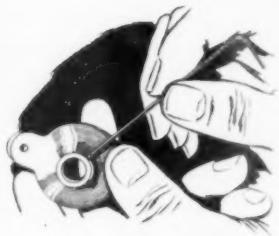


Two UNBRAKO Self-Locking Socket Set Screws are used on each cam of these precision multicircuit cam timers. The screws position the cams so as to control accurately the sequence and duration of one or a series of individually timed machine or process operations.



Assembler picks up tiny UNBRAKO set screw with long arm key preparatory to threading it into cam assembly.



He inserts the UNBRAKO, and turns it into the assembly; then after positioning cam, tightens it. The accurate depth and size of the hex socket result in maximum torquing—the knurled cup point holds the cam accurately in place.

UNBRAKOs—made of heat treated alloy steel—have fully formed threads, Class 3 fit; are supplied in standard sizes from # 4 to 1".

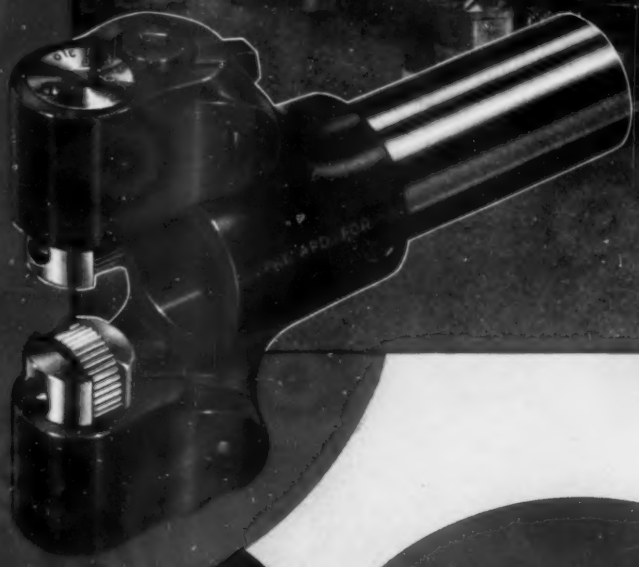
You'll need less space for storage when you use UNBRAKO Standards—stocked by your distributor

You'll need less space for storage and be able to carry a smaller inventory, because standard UNBRAKO socket screw products are in stock at your local industrial distributor's. And you'll save time and money, because deliveries are prompt. For more information, write for UNBRAKO Standards—a complete listing of socket screw products made by the world's largest manufacturer of these precision fasteners. STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

UNBRAKO® SOCKET SCREW DIVISION

SPS JENKINTOWN PENNSYLVANIA

R and L KNURLING TOOL



HALF THE WEIGHT . . . TWICE AS EFFICIENT AS OTHER KNURLING TOOLS, ONE HEX WRENCH MAKES ALL ADJUSTMENTS!

The convenient position of the set screw enables you to get to work faster by cutting down your set-up time. The set screw locks the knurl pin securely . . . also allows knurl changing without removing the holder from the turret. The R and L KNURLING TOOL is available in a complete range of sizes. Knurls can be adjusted to any angle, producing either straight or diamond patterned knurling.

RIGHT R and L LEFT TOOLS

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BAY STATE TAPS

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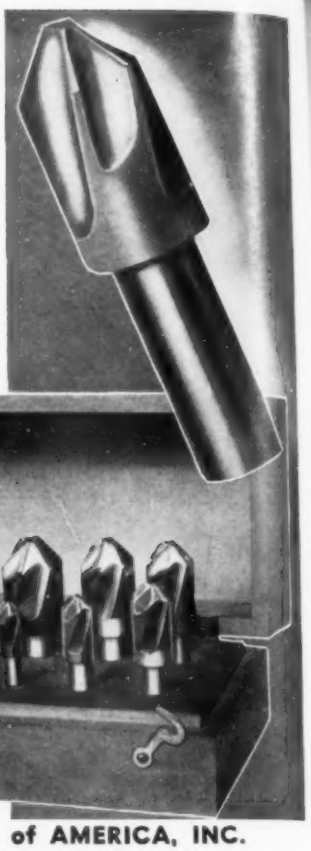
Made in 12 sizes in all degrees; also supplied as sets in strong Kit-cases.



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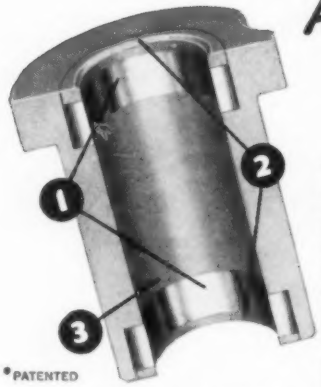
MORE ACCURACY—
FASTER—
AT LESS COST



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1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

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Carbide Inserted Bushings
Are Doing It Daily!

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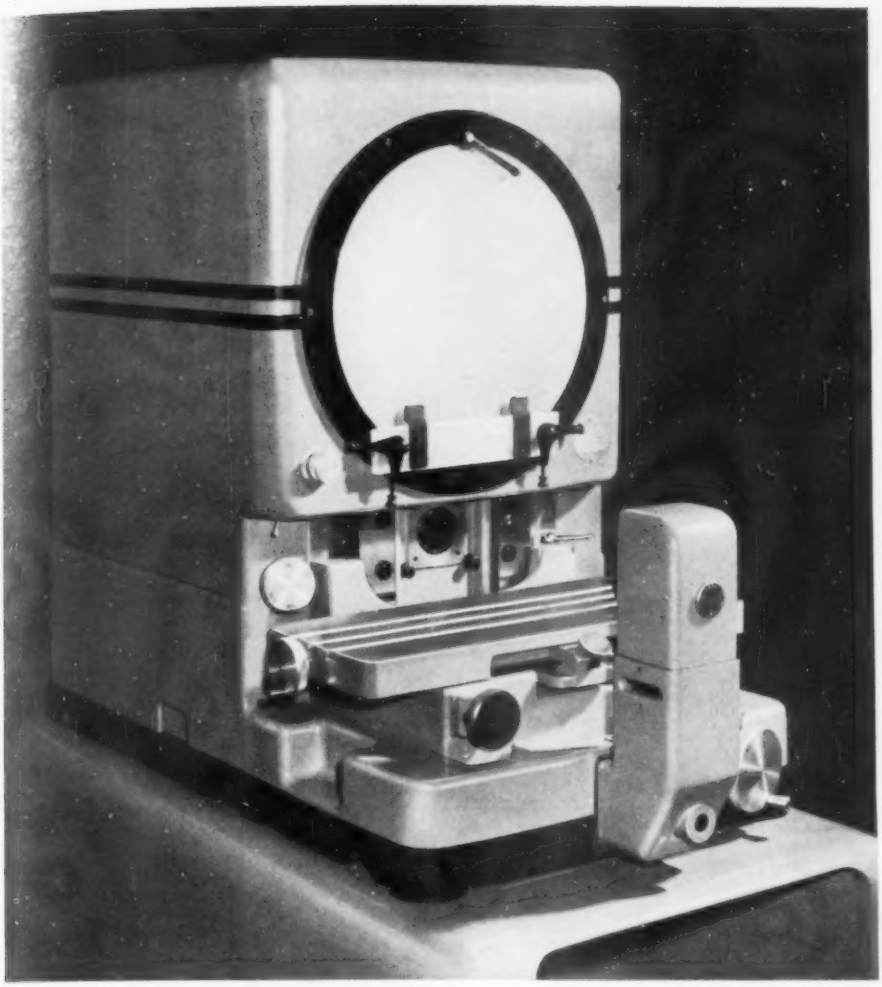

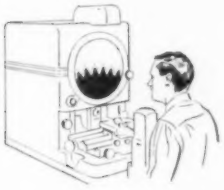

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OUTSTANDING FEATURES:

A precision machine for drilling, boring, recessing, and milling work. Table can be rotated to 360 degrees. Accurate automatic locking of rotary table every 15 degrees, and at any other position by hand. Table and spindlehead have variable hydraulic feed. All coordinate dimensions can be set by dials, and adjustment made through optical microscopes. Mechanical spindle feed can be changed without stopping machine. Automatic stop of spindle feed. Optical measuring system operates in conjunction with vernier scales. Vertical movement of column motor operated.

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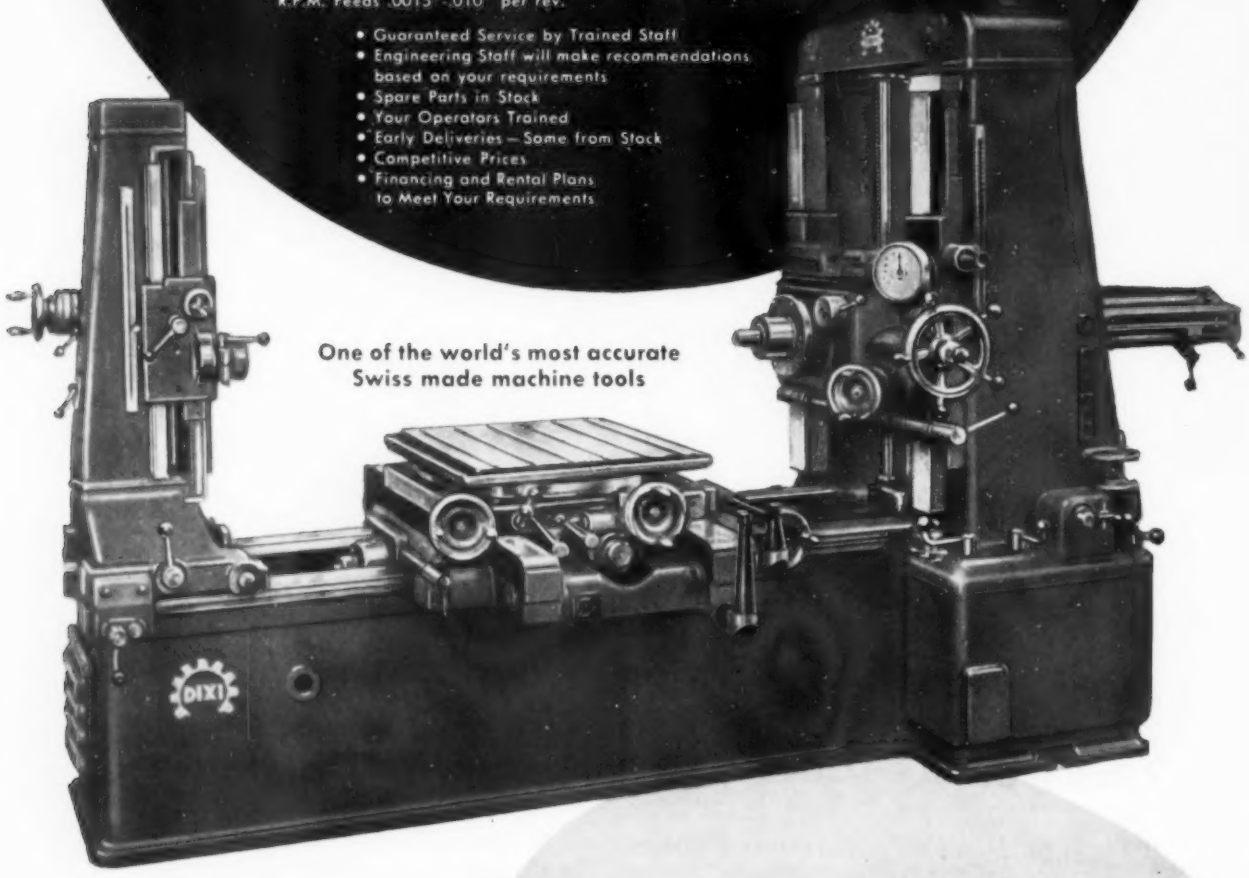

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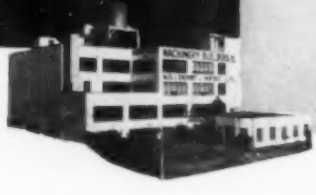

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LONG LIFE

Although taps are expendable . . . the ability of Bath ground thread taps to stand up between "grinds" has created an acknowledged reputation for long life.

Long wear depends on many things — selection of the right tap for the material to be threaded — the use of the best speed — the right lubrication — and, in addition, the tap itself must be properly designed and made from high quality steel of uniform structure.

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Bath engineers check every detail, to see that all Bath Taps are conditioned to do the best threading job for your requirements.

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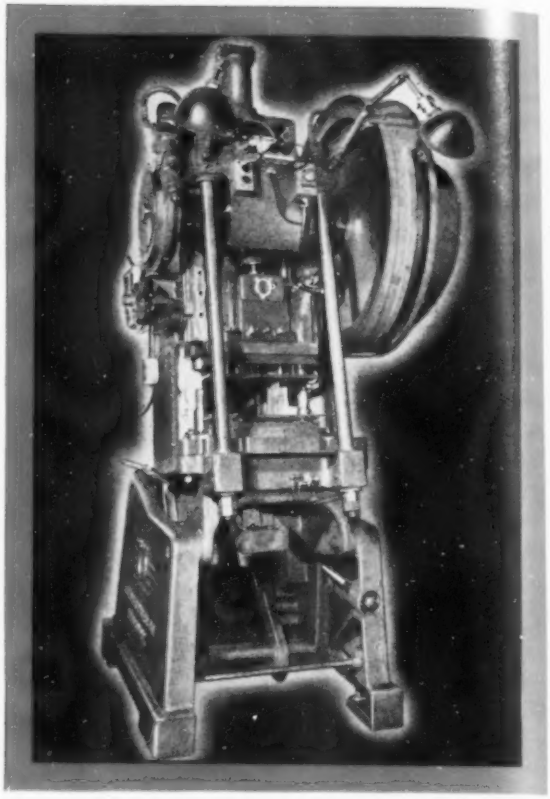

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If you use shoulder or set-screw type punches, you have excessive press down-time when replacing worn or broken punches.

But, with R-B interchangeable and standardized punches and die buttons you get quick insertion and removal in the press. The R-B ball lock features, that assure positive radial alignment and vertical locking without further keying, permit greater press utilization.

Use R-B Engineering Service for Your Tough Piercing Problems.

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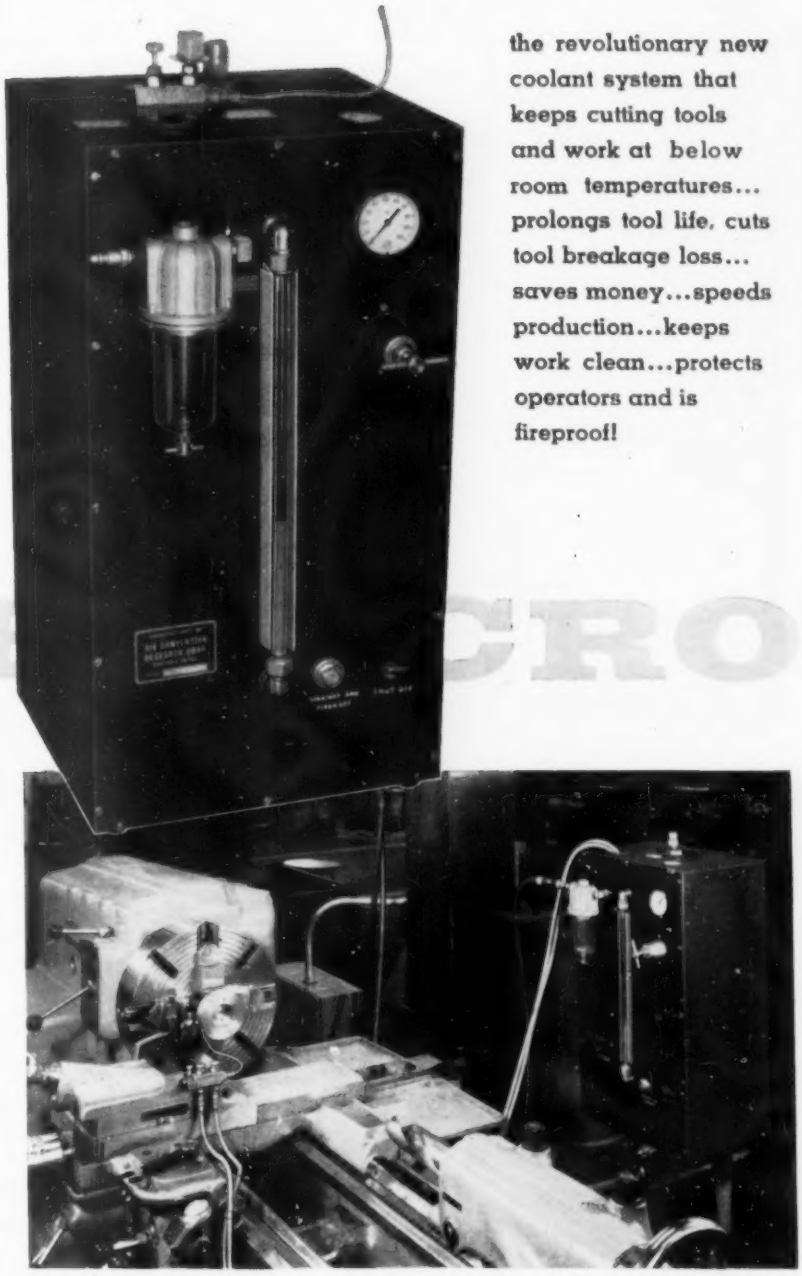

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Has fine ground lenses of optical glass. Neutralizes eye strain from close work. Binocular design gives third dimensional vision. Allows freedom of both hands. Wear over glasses. Plastic frame with adjustable headband.

SIZES: 20" focal lgth. 1½ power — 14" focal lgth., 1¾ power, 10" focal lgth., 2½ power; 8" focal lgth., 2¾ power ..... price each ONLY 10.50

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We stock over 100,000 Hydraulic Cylinders in 106 different types and sizes. These can be adapted wherever tremendous power is needed to push, pull, hoist, mould or drive, etc.

SPECIAL

Gives 30,000 lb. thrust using 1500 PSI line pressure as obtained from our hydraulic pumps. Will produce up to 60,000 lb. thrust with 3000 PSI. Can also be used on a low pressure air system. Has 4" bore; 18" strokes; 30½" long. Ideal for shop. USED 29.95

Part No. 29 NEW 43.95

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See our complete line. Pullers for Gears, Bearings, Wheels, Pulleys, Bushings, Shafts, etc.

NEW 10 TON HYDRAULIC PRESS

SIZE: 60" high 27" wide 29" base

Use this Press in the Shop or take it with you on the job. Frame is 4" welded channel iron. Has 6½" stroke, 2½" diam. ram. Valve operates piston in both directions. Adjustable platform. Positive power Hand Pump with handle. 2000 PSI pressure gauge. 129.00

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Operating pressure 1500 PSI. Cap., 1.5 cu. in per complete cycle ... 12.75

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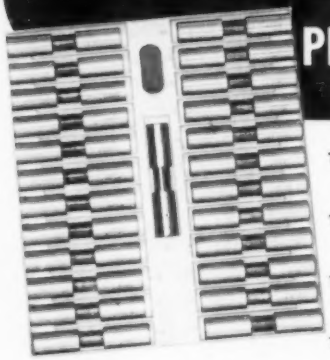
CLOSER TOLERANCES with DELTRONIC TENTH PLUG GAUGES



★ Size variation by ten thousandths

★ Set of 25 costs approximately same as Go and No-Go gauge.

★ Available in increments of 1/64" from 1/8" to 1"

★ Hardness is Rockwell C62/C64

This new system of precision gauging provides one gauge of nominal size plus 12 gauges of increasingly larger sizes in .0001" increments and 12 gauges of decreasingly smaller sizes in increments of .0001". Each gauge is identified. It is the same size on both ends to double the life in usage.

For further information write Dept. D12.

DELTRONIC CORPORATION

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Multiform

BIG BROTHER BENDER

Produces Without Special Tooling—Saves Die Costs Saves on Expensive Presses

Model BBB

Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender, using the standard tooling.

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches—punching and blanking dies extra. Will punch holes up to 1" and form material up to ¼" thick by 4" wide. We also build smaller hand or air operated models for forming up to ⅛"x1½" material.

Send for illustrated folder TE-5

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J. A. RICHARDS CO.

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W.H.O.* SAYS:

"Don't have FITS over FASTENERS, have fasteners that fit."

For the finest in milled-from-the-bar cap screws — set screws coupling bolts and milled studs

don't get stuck—stick to the ones made by

*Wm. H. Ottemiller Co. YORK, PENNA.

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DON'T SCRAPE DON'T SCRAP worn surface plates them either . . .

Step them down and continue using them for less accurate work.

You'll save enough money to replace with Rahn Diabase for your most accurate work.

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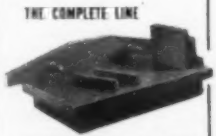

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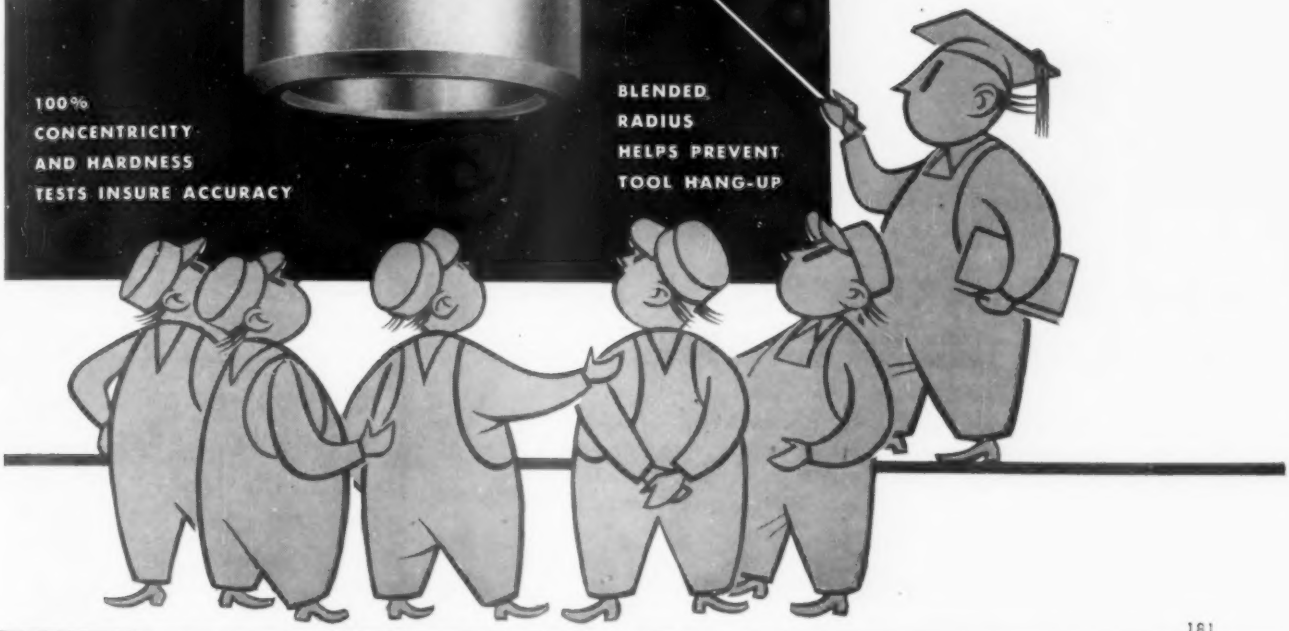
INSURE PERFECT ALIGNMENT AND LONG LIFE OF PRODUCTION TOOLS

KNURLED HEADS PROVIDE GOOD GRIP
SUPERFINISH BORES REDUCE TOOL WEAR
100% CONCENTRICITY AND HARDNESS TESTS INSURE ACCURACY
BLENDED RADIUS HELPS PREVENT TOOL HANG-UP

Universal Drill Bushings are available in a complete range of standard sizes and lengths. Special sizes made to order. Write to Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.; or the home office.



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UNIVERSAL ENGINEERING COMPANY

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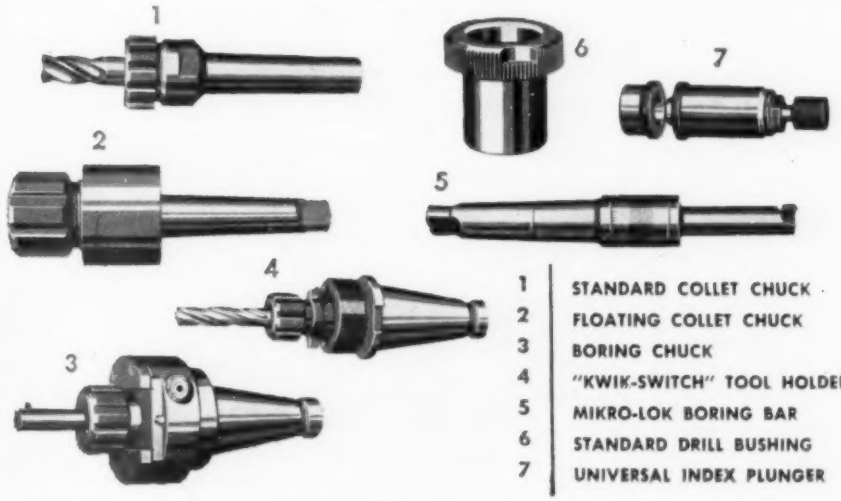

1 STANDARD COLLET CHUCK
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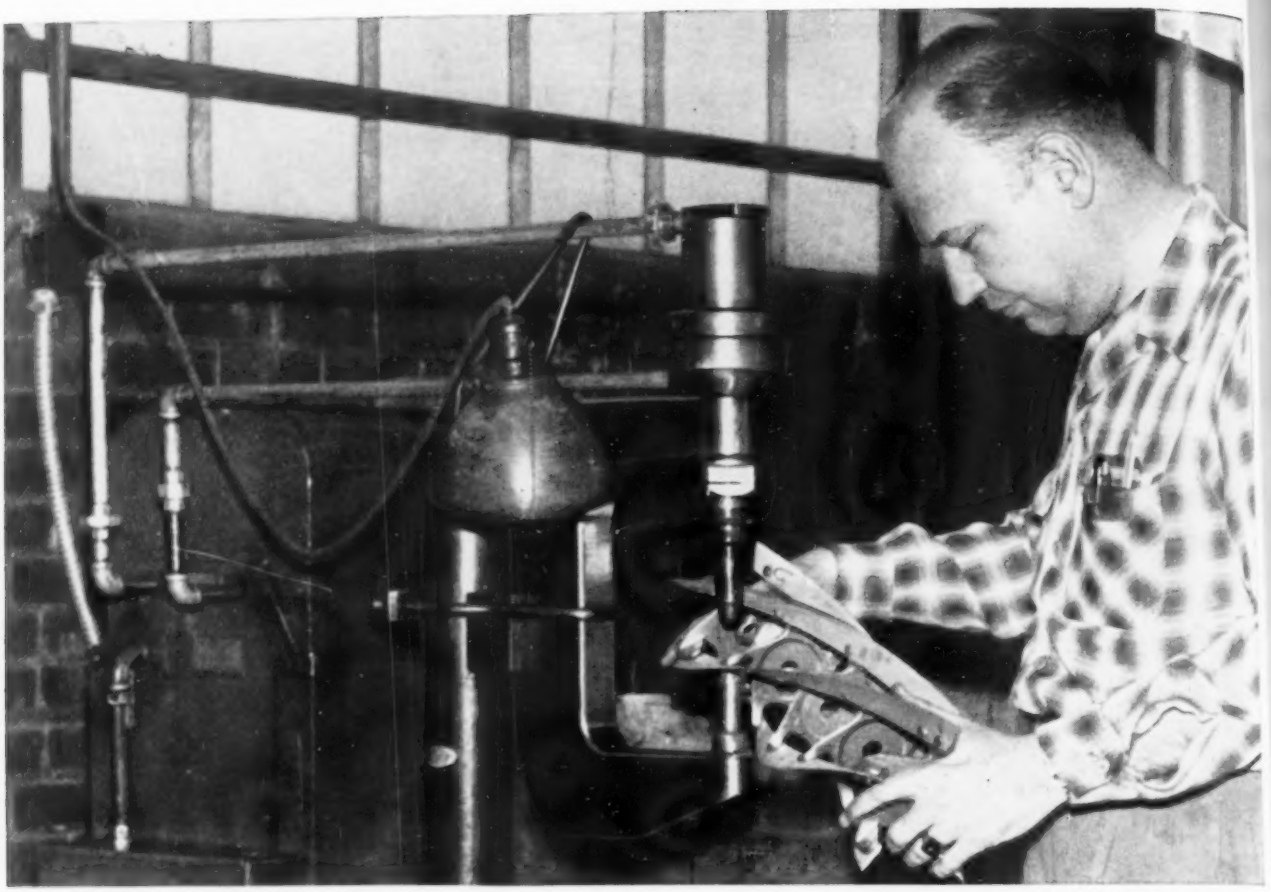
5 MIKRO-LOK BORING BAR
6 STANDARD DRILL BUSHING
7 UNIVERSAL INDEX PLUNGER



Courtesy Eclipse Lawn Mower Company, Prophetstown, Illinois

HOW TO MAKE A BETTER ASSEMBLY CHEAPER

RIVETING THE "HY-POWER" WAY

Lawn mower blades must be fastened to the reel tightly and *in perfect alignment* to assure product performance and acceptance. That's why the Eclipse Lawn Mower Company, Prophetstown, Illinois (as well as many other leading lawn mower manufacturers), uses Hannifin "Hy-Power" cold-squeeze riveting.

What's your assembly problem?

If you haven't investigated fast, safe, clean cold-squeeze riveting, perhaps you should! Parts are drawn tightly together under quiet, relentless hydraulic pressure. Rivet shanks expand to fill the hole completely, making the tightest joint possible; heads are formed to any shape and every rivet is identical. And, with this modern push-button-controlled method, operators need no special training to apply it.

"Hy-Power" Riveters are available, standard or special, for portable use or in fixed mountings, as shown. Power source is the exclusive Hannifin "Hy-Power" Hydraulic Pressure Generator—so dependable that the first model, made nearly 20 years ago, is still in daily use.

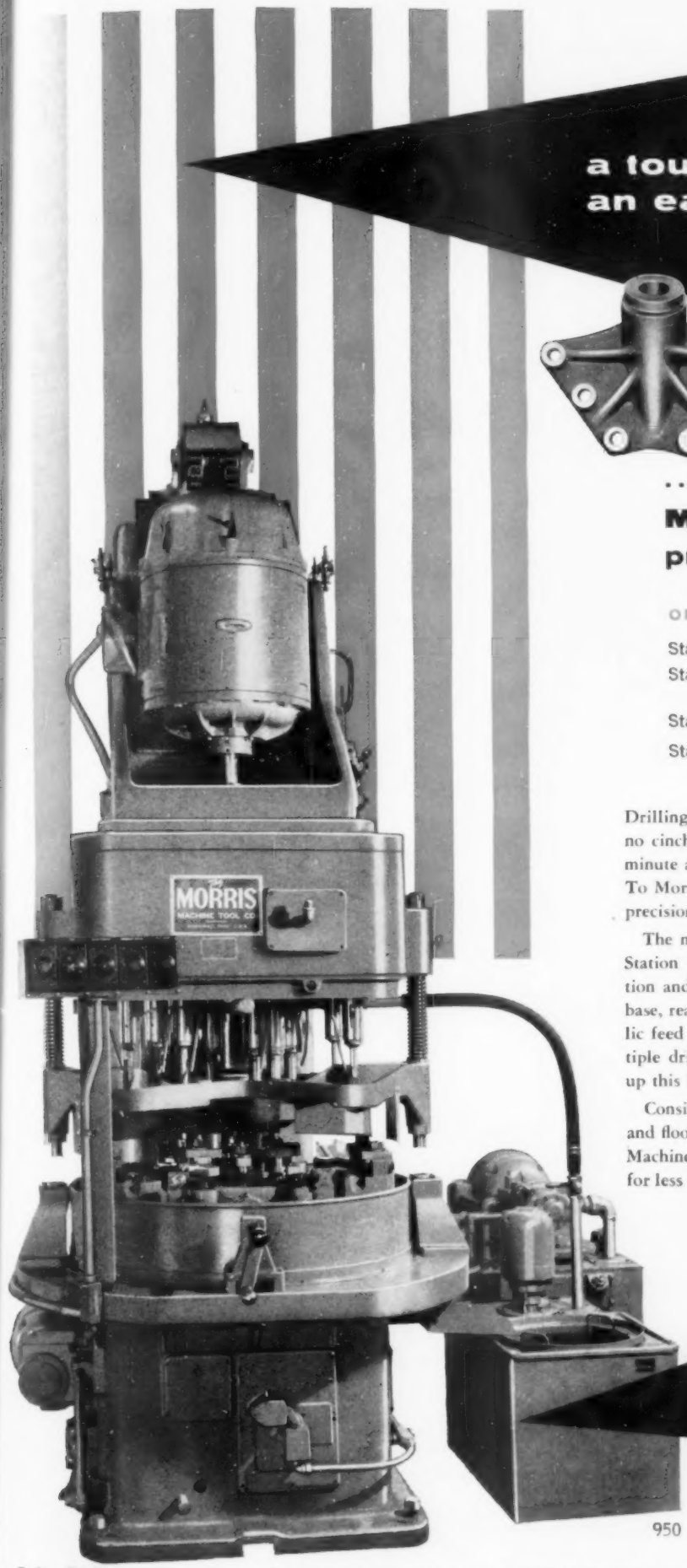
ONE RIVET AT A TIME OR SEVERAL!

Hannifin "Hy-Power" Riveting is ideal for multiple installations where several "Hy-Power" Cylinders—available in capacities from 7½ to 100 tons—advance, rivet and retract in unison. Your Hannifin representative is anxious to help you select exactly the "Hy-Power" installation you need. Why not call him in? Meanwhile, get the full story by writing for Bulletin 150.

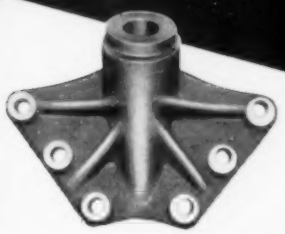
HANNIFIN

Hannifin Corporation, 1119 S. Kilbourn Ave., Chicago 24, Ill.

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves



a tough job...
an easy solution



...another **MORRIS MOR-SPEED** production machine

OPERATIONAL CYCLE:

Station	1	Load and Unload
Station	2	Drill two 57/64" holes Drill four 29/32" holes
Station	3	Spot face six holes
Station	4	Ream (.9062") two holes

Drilling six large holes in armor plate forgings is no cinch, but when you want a finished part every minute and twenty seconds, that's a tough problem. To Morris Engineers, it was a familiar problem... precision drilling on a mass production basis!

The machine furnished was a MOR-SPEED Four Station Vertical, giving "special machine" production and precision at remarkably low cost. Standard base, rear column, indexing table, slide and hydraulic feed mechanism are combined with special multiple drilling head and work fixtures . . . to make up this high production machine.

Consider the savings . . . investment, labor, time and floor space . . . offered by Morris MOR-SPEED Machines. Precision high production can be yours for less than you might imagine!

Morris

950 HARRIET STREET CINCINNATI 3, OHIO

Continuous Operation
High Production
Accurate Flat Surfaces

No time lost in loading and unloading parts on new Model 844 Microflat Machine.

New type multiple-station, self-actuated fixture and more selective controls give this machine a production capacity of a finished part every 3 seconds.

For complete description of this new Microflat Machine write for CROSS-HATCH, Vol. 6, No. 1.

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PRECISION PRODUCTION THROUGH MICROHONING
MICRO MATIC
25TH YEAR OF DEVELOPMENT

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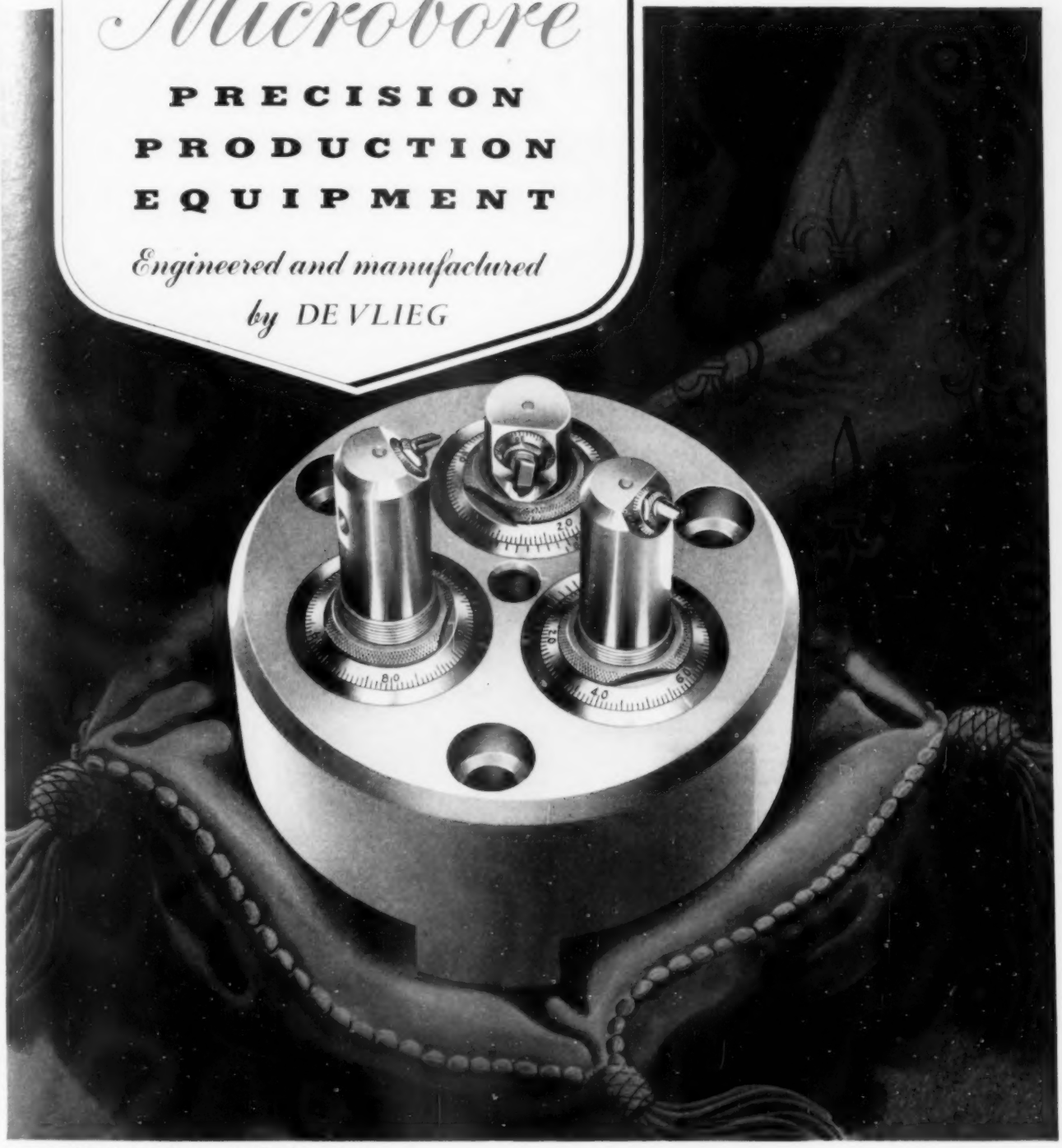
PRECISION PRODUCTION EQUIPMENT

Engineered and manufactured by DEVLIEG



Courtesy of the Emerson Electric Mfg. Co., St. Louis, Mo.

Illustration shows Microbore cluster tool furnished to Emerson Electric Co., for finish turning O.D.—finish boring I.D. and facing operations at one pass. Standard Microbore units are arranged to provide micrometer vernier adjustment for both radial and linear settings of the cutting tools.

Send for new illustrated catalog.

Discuss your tooling problems with our Microbore specialists

DEVLIEG MICROBORE COMPANY 480 Fair Avenue, Ferndale • Detroit 20, Michigan

How to Cut the Cost of Gaging Threads

with TAFT-PEIRCE JOB-RATED GAGES

The *best* gage for most jobs provides the *best* combination of speed, wear-resistance, upkeep, and initial cost. Here are some comparisons that will help you keep costs to a minimum.

Thread Plugs

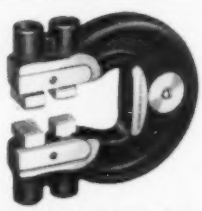
T-P Limit Thread Plug Gage. Standard hardened steel gages are lowest in initial cost and are preferable when soft or moderately hard materials are being inspected in limited quantities. Taper-Lock up to 1.510″. Reversible from #0 to ½″. Reversible Tri-Lock above 1.510″.

T-P Electrolized Gages. With only a modest increase in initial cost, substantially longer wear life can be obtained with this exclusive surface treatment. Many users report up to 3 times longer gage life.

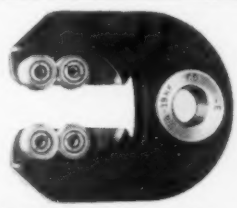
T-P Carbide Thread Plug Gage. For exceptional resistance to abrasion or scratching and maximum wear life. Furnished in both standard and special sizes — from #8 machine screw size up.

Rings & Snaps

T-P Thread Ring Gages. Lower in initial cost than other gages for external threads, they check a combination of all thread errors but cannot distinguish between them.



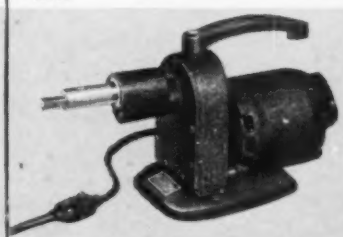
T-P Adjustable Thread Snaps. Faster than ring gaging, and just as accurate, they check lead, angle, and all other thread elements. Pitch diameter is variable.



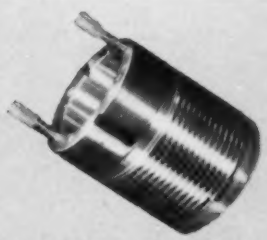
T-P Roll Thread Snaps. Same as adjustable, with *rolls* for gaging members. Since gaging members rotate, wear is spread over greater surface and service life increased.

Special Gages

T-P Rotochek (Flexible Shaft Model). Fastest thread gaging method yet devised. Push —and the gage screws into the work. Release the pressure and it stops. Pull—and it disengages. Can be used with most standard T-P plug or ring gages.

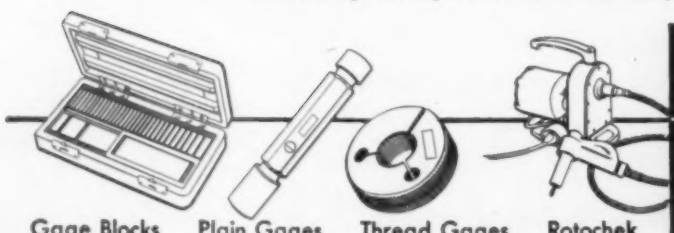


T-P Rotochek (Bench Model). Permits bringing work to gage, instead of gage to work. Like flexible shaft model, records indicate it triples rate of parts inspection.



T-P Thread Concentricity Gage. Typical of the infinite variety of special gages made to order by T-P every year. This one checks size and location of internal threads.

For the complete story on these items and many more, send for your copy of the Taft-Peirce Handbook.



Gage Blocks Plain Gages Thread Gages Rotochek

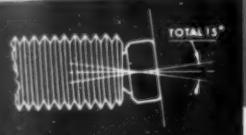
T-P means Top Precision

T P

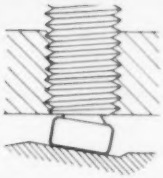
THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, R. I.

Here's the secret to positive clamping... freedom from marring!

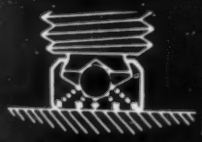
the New Vlier SCREW-BALL CLAMPS!



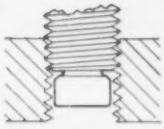
Ball-bearing construction insures frictionless, *automatic* angle adjustment and rotation; pad swivels freely in *all* directions up to 7½° from the centerline!



Pad seats firmly on work surface within angular range!



Force distributed equally to pad face. Conical seat distributes force equally in all directions; insures easy alignment in angular applications; greater freedom of motion.



Pad inserts from top of threaded hole or from bottom for easy installation!

Large pad area. Pad is machined from the solid, not counterbored or relieved; has greater strength plus freedom from distortion!

NO MORE EXPENSIVE, CUSTOM-MADE SWIVEL PADS . . . 17 size variations; ¼" O.D. up. N.C. threads; class 2 fit.

LOW COST... Saves hundreds of dollars annually in toolmaker's time!

NO MARRING... Rotation of pad ceases at first touch against the work! Soft seat saves surfaces!

HEX SOCKET HEAD... for easy hex key adjustments!

BLACK AS THE ACE OF SPADES! Completely rust proofed end to end!

KEEP VLIER SCREW-BALLS IN STOCK FOR INSTANT USE—SAVE YOUR TOOLMAKER'S TIME!

Ask your Vlier Distributor for an assortment of sizes today!

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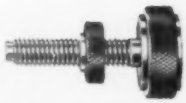
MONEY-SAVING TOOLING SPECIALTIES FOR EVERY REQUIREMENT!



TORQUE THUMB SCREWS— Apply accurate, controlled end pressures; eliminate distortion to the workpiece. 4 models; 19 sizes!

VLIER SPRING PLUNGERS— For use wherever accurate, positive spring loads are needed! 4 models; 40 sizes!

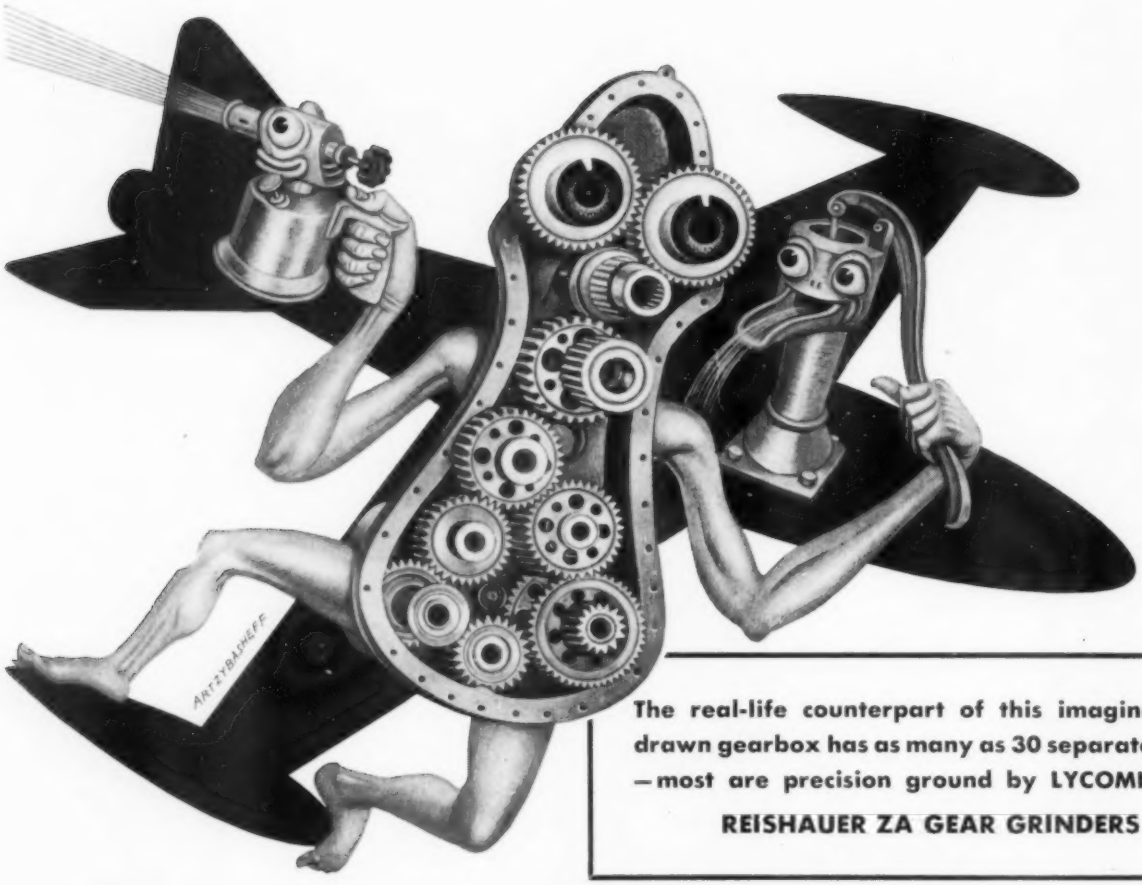
VLIER SPRING STOPS— Provide end pressures in fixtures when wall sections are not available. Two models: 14 and 32 lbs. end pressure.

VLIER TOGGLE PADS— Assure solid clamping of parts with uneven or off-angle surfaces. 5 sizes; fit almost any clamp.

VLIER FIXTURE KEYS— New 5-Way Key fits every standard mill table slot. 3-Way model also available.

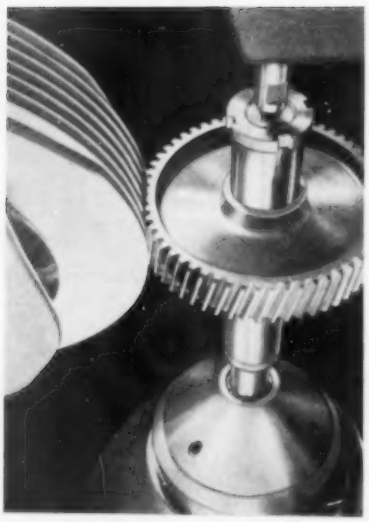
Write for your complete catalog of Vlier products today! It's free!

Precision gears go flying



The real-life counterpart of this imaginatively drawn gearbox has as many as 30 separate gears —most are precision ground by LYCOMING on

REISHAUER ZA GEAR GRINDERS



Single-thread grinding worm and spindle of the Reishauer ZA.

Auxiliary "nerves" of the mighty J-40 and J-47 jet engines, these precision gears transmit power to run fuel and oil pumps, generators, and other vital accessories. Lycoming, maker of this intricate gearbox, depends on Reishauer ZA gear grinders for precise, rapid production of gears.

Lycoming likes the way Reishauer consistently produces gears to extremely close tolerances at high production speeds. Furthermore, operators on the production line benefit from the simplicity and cleanliness of the machines' operation.

Lycoming is not alone in its respect for Reishauer grinders—these machines are widely used to grind spur and helical gears in the automotive and aircraft industries. Other users include machine tool builders, gear-jobbers, and instrument manufacturers.

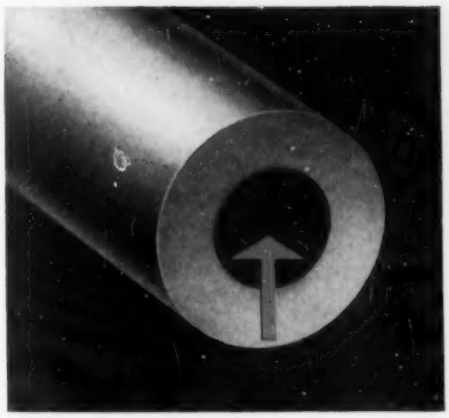
In short, Reishauer ZA grinders are excellent machines. If you want proof, we'll be happy to supply it. Get in touch with us soon, won't you?

COSA CORPORATION
405 Lexington Ave., New York 17

Your source for all Precision Machine Tools— from Small Bench Lathes to Large Boring Mills

IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

a hole here makes waste...



a hole here makes a saving

Crucible Hollow Tool Steel Bars **are a boon to the metalworking industry. The hole in these quality bars enable toolmakers to eliminate drilling, boring, cutting-off and rough-facing operations. This cuts production time, boosts machine capacity and saves scrap losses.**

They are available now, in any of Crucible's famous tool steel grades, in almost any combination of O.D. and I.D. sizes. And you can get *immediate* delivery of five popular grades — KETOS oil-hardening, SANDERSON water-hardening, AIRDI 150 high carbon-high chromium, AIRKOOL air-hardening, and NU DIE V hot-work tool steels — from a conveniently located Crucible branch warehouse.

Let your Crucible representative show you how these steels can best help *you*.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **HOLLOW TOOL STEEL**

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You can sharpen

4,800

½ x ½ tungsten carbide

insert tools with this $45

brass wheel and

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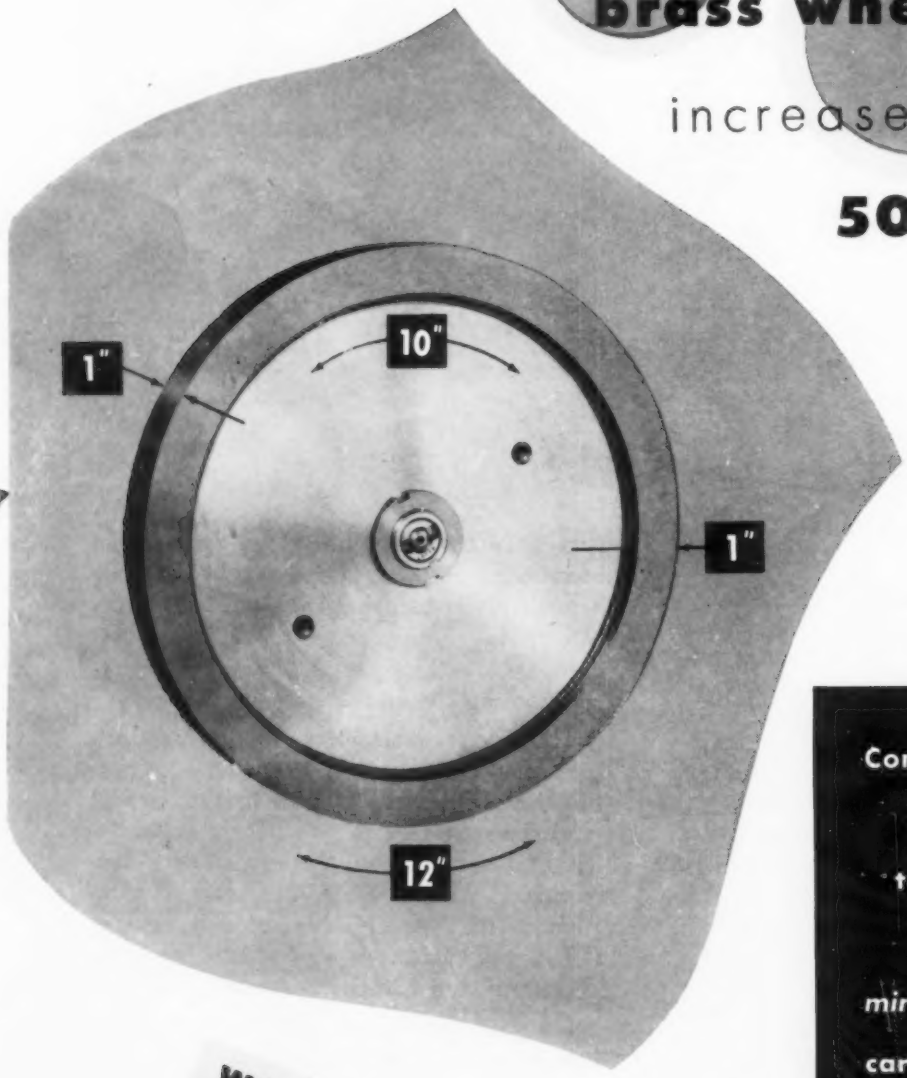

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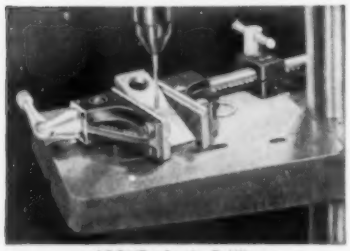

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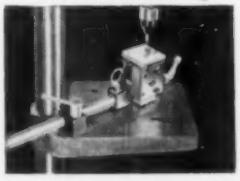

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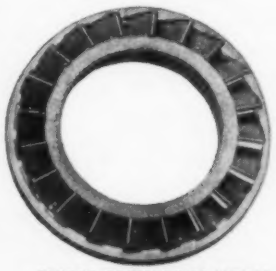

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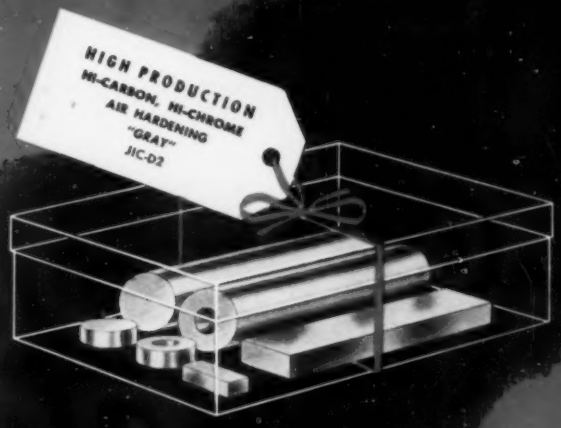

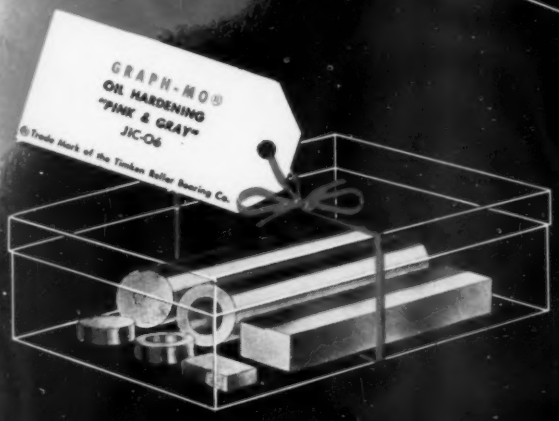

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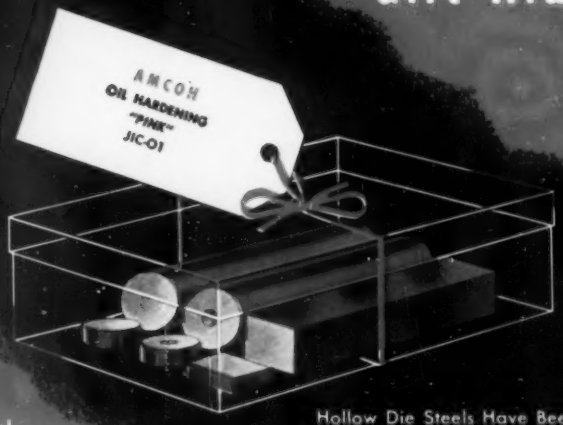

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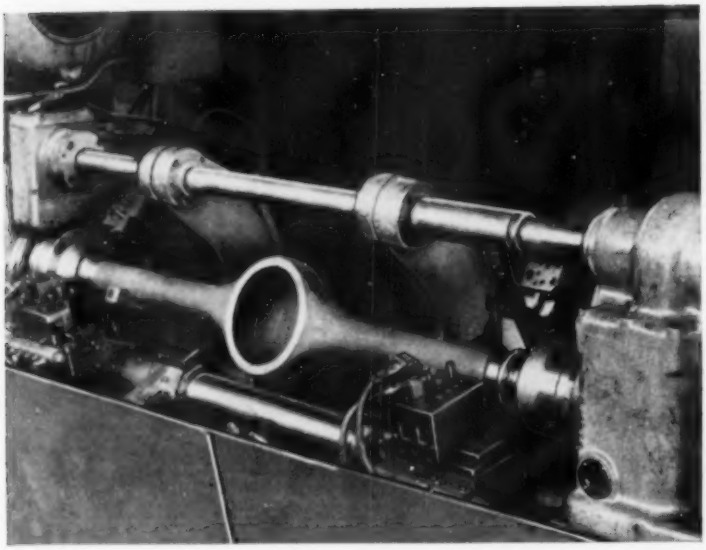

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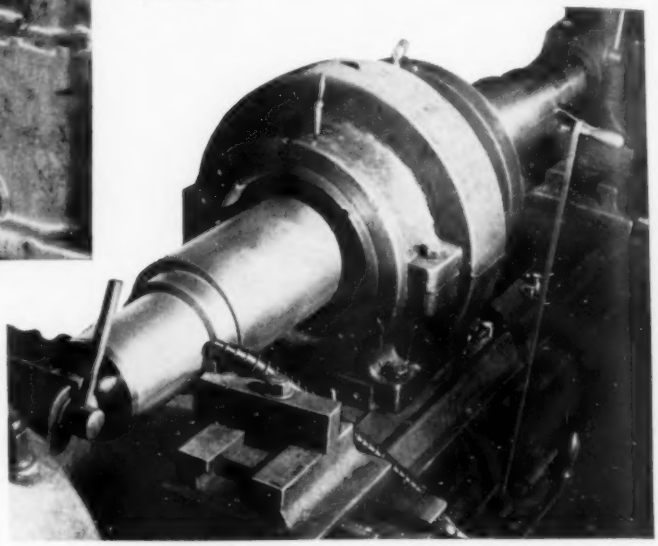

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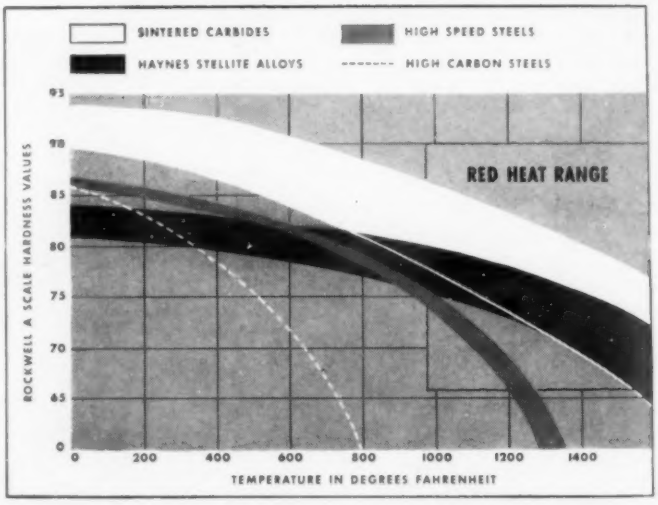

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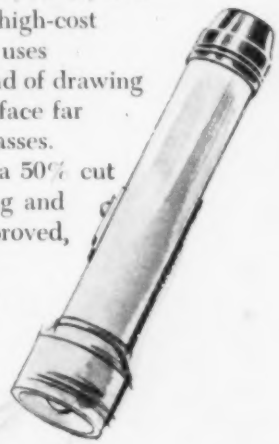

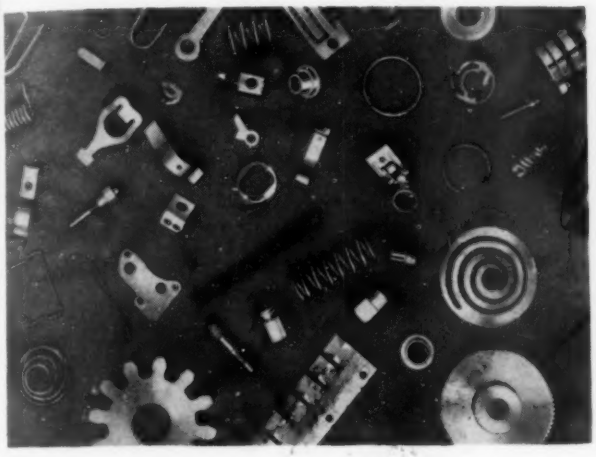

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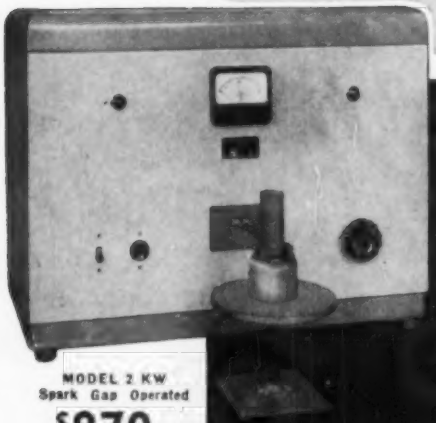

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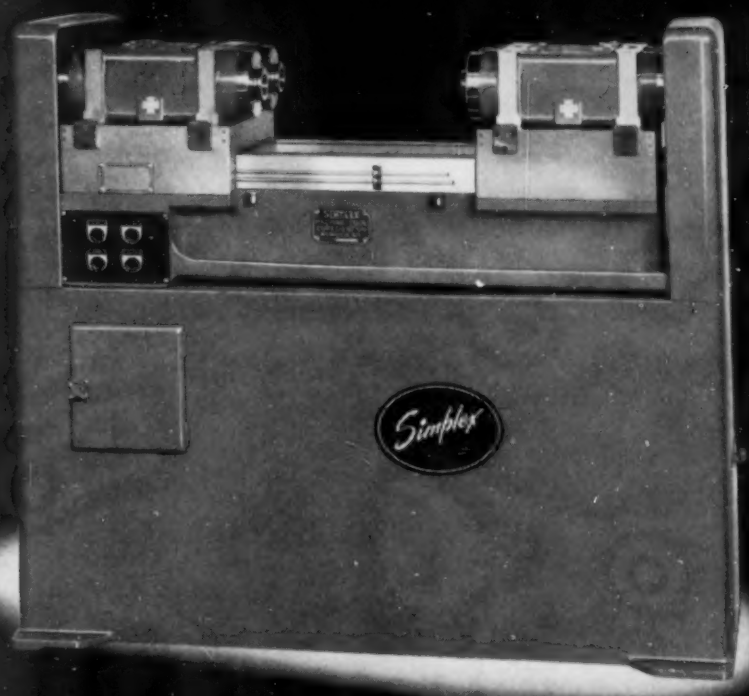

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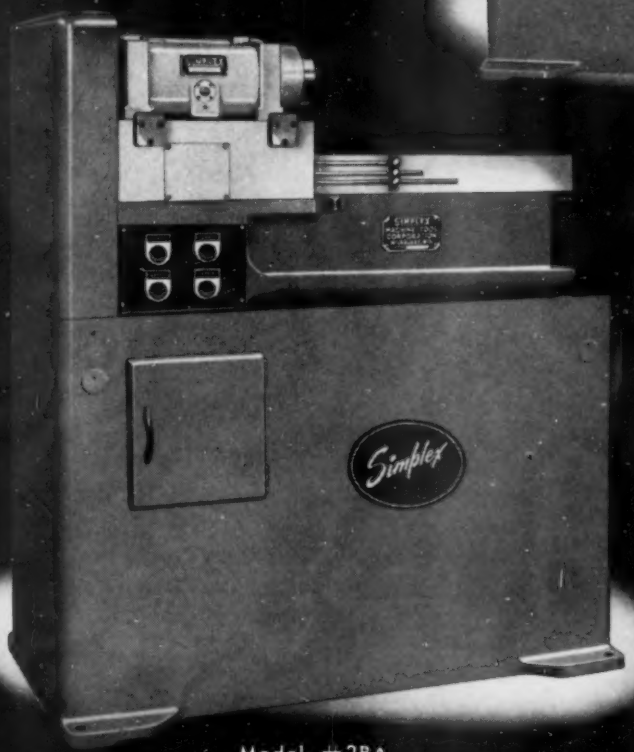

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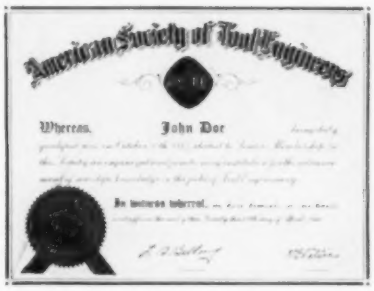

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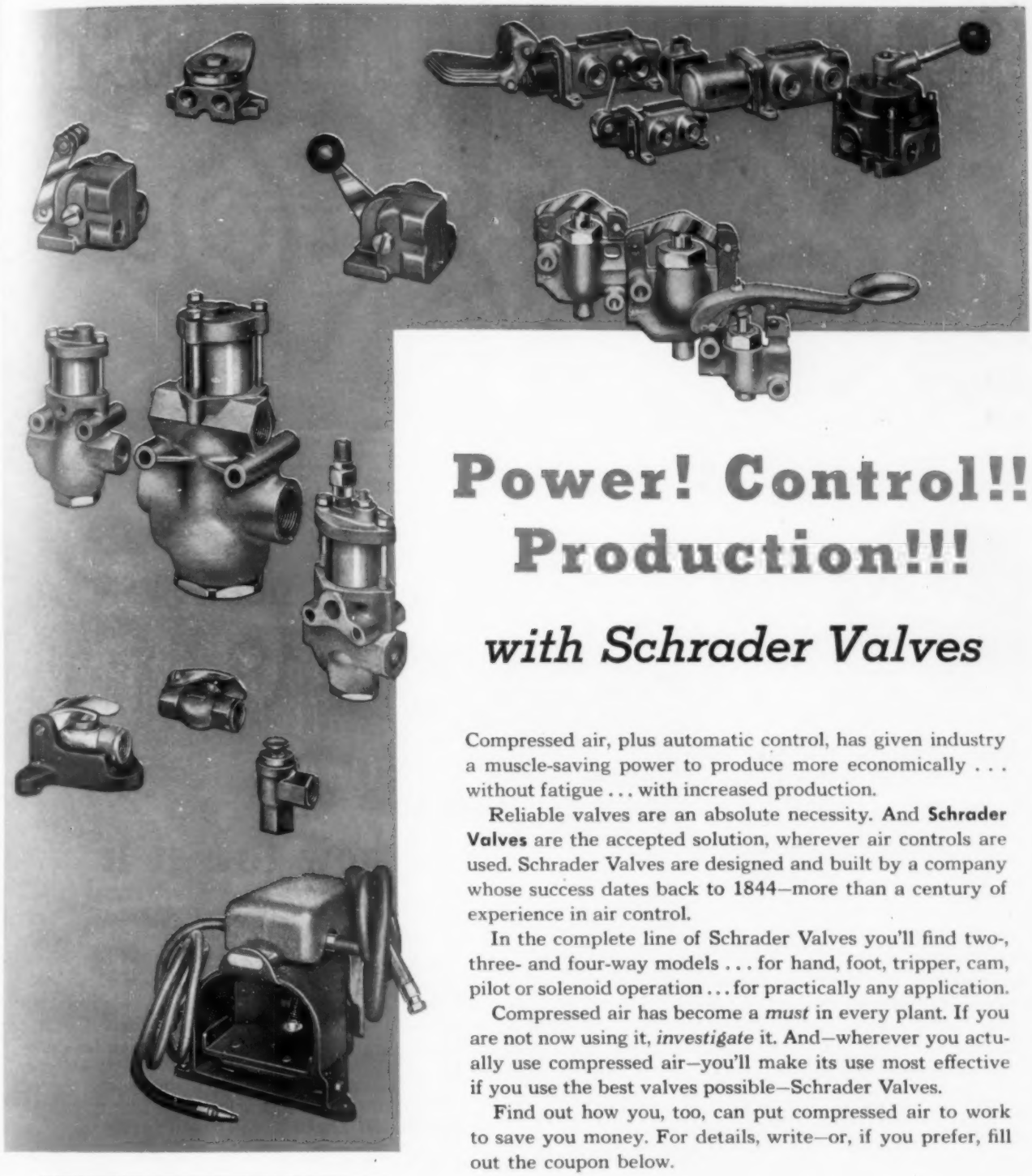

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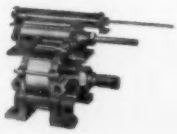

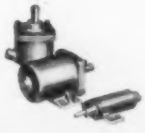

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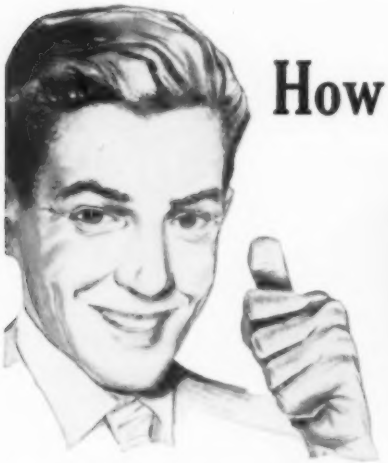

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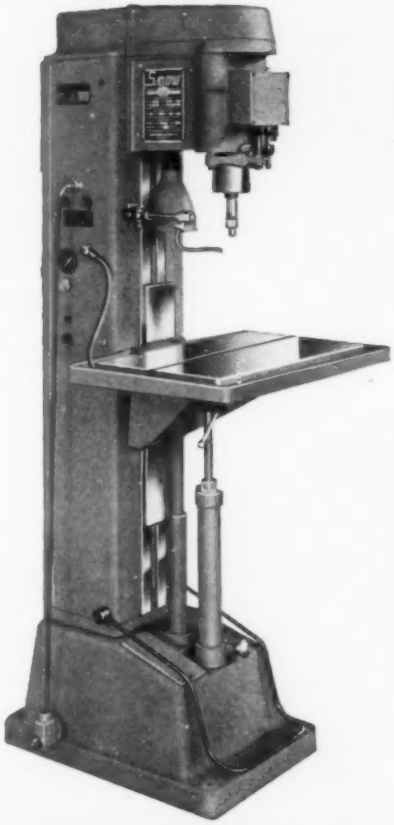

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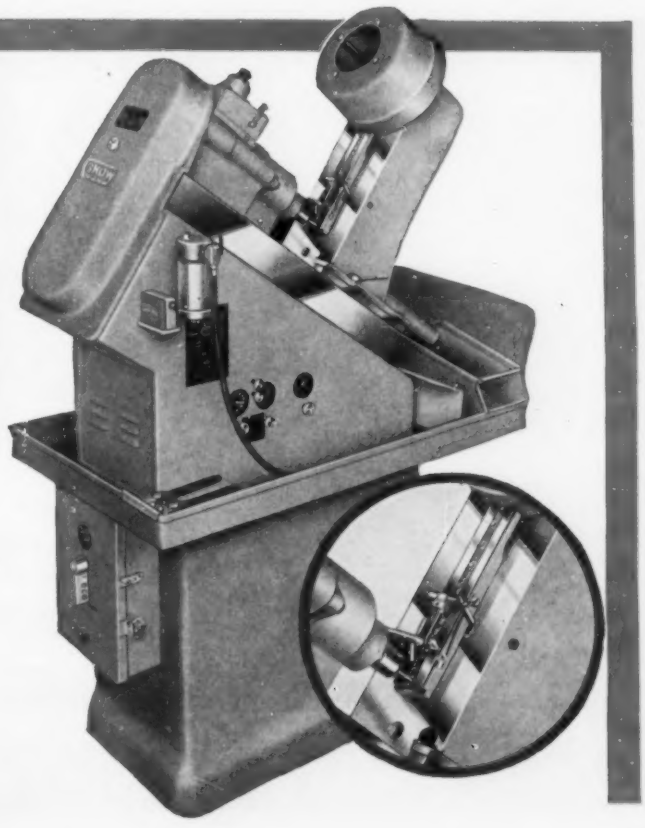

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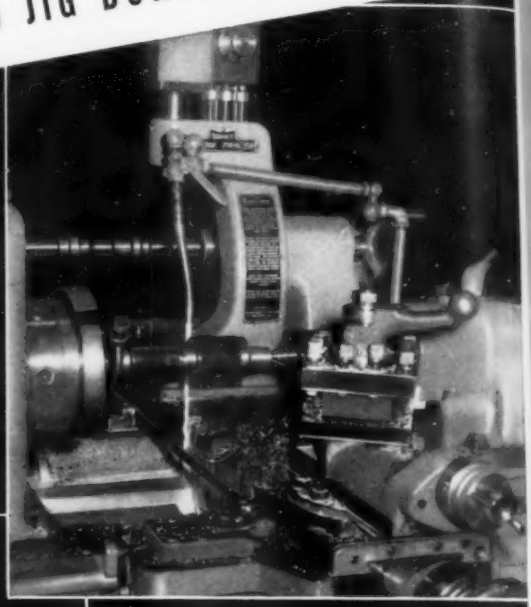

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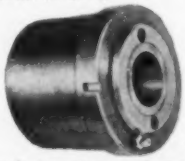

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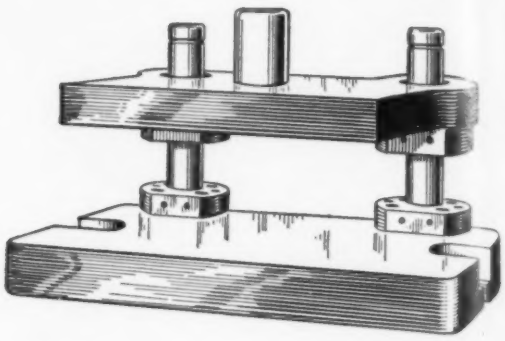

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We can't tell you much about the manufacturing processes at the L. A. Young plant (due to security restrictions) . . . but we can tell you about the many rugged construction features of this equipment . . . features which make it so dependable that the L. A. Young organization selected Lindberg Induction Heating Units for their important Department of Defense work. These points of design and construction will minimize costly breakdowns and aggravating work stoppages:

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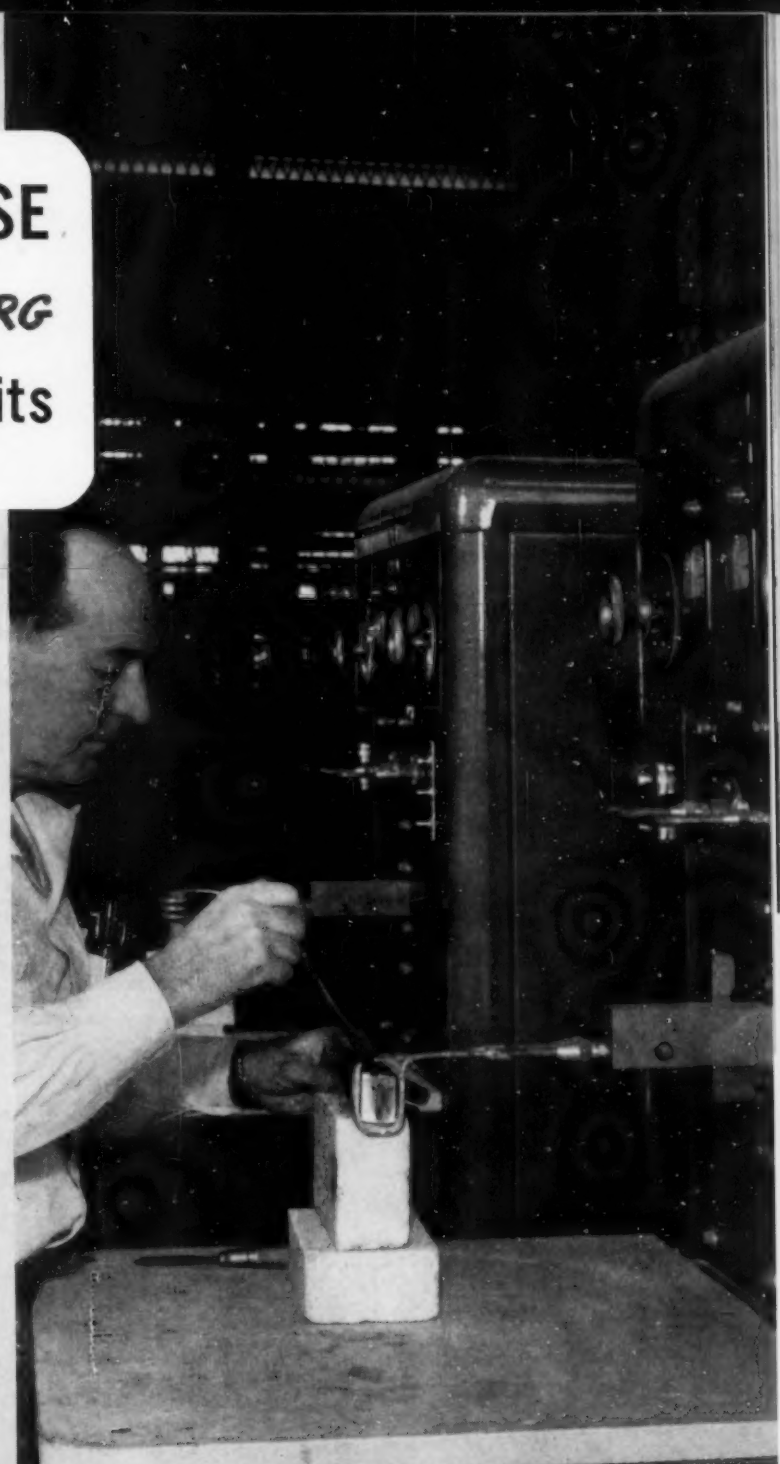

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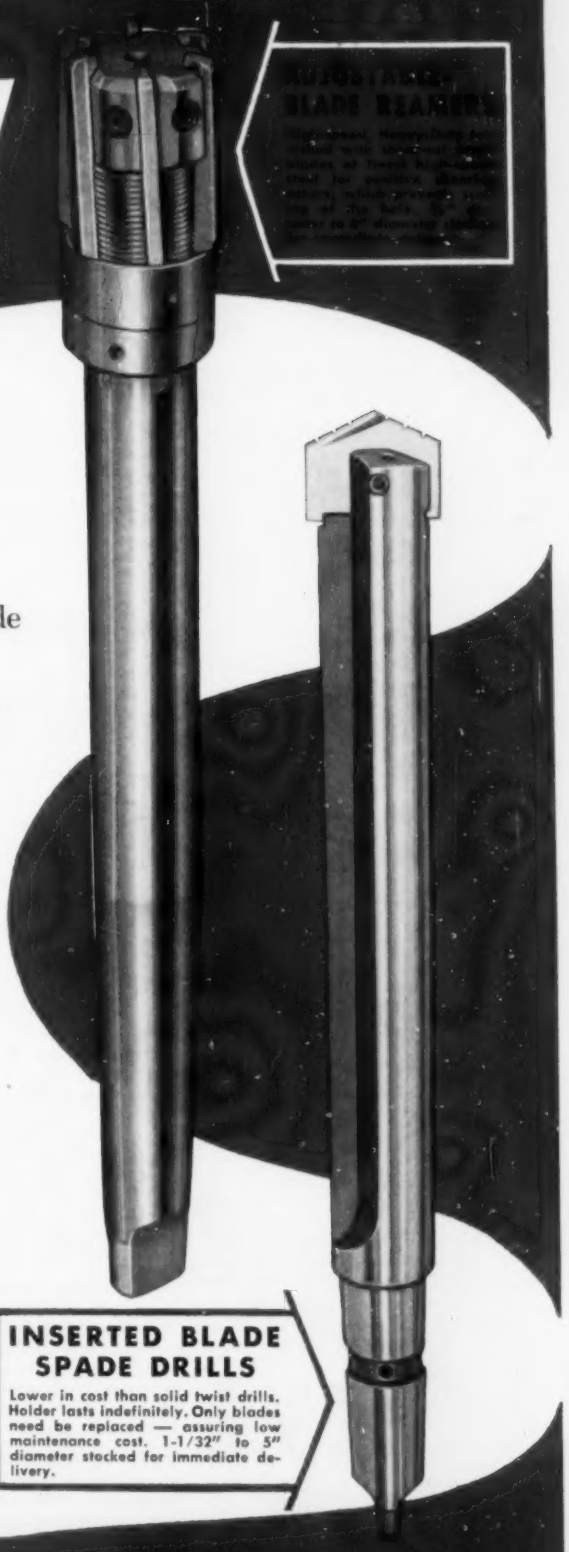

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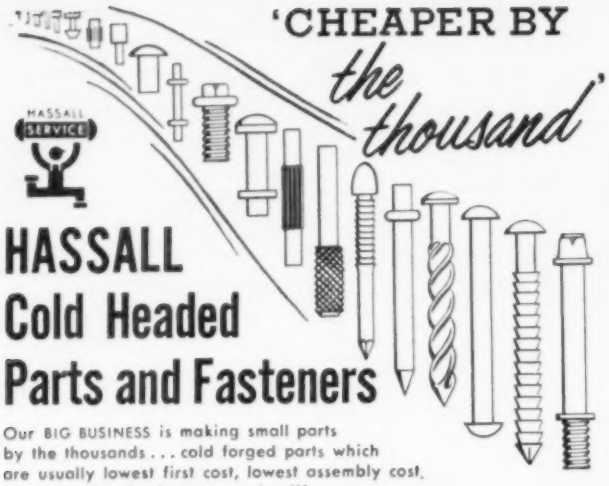

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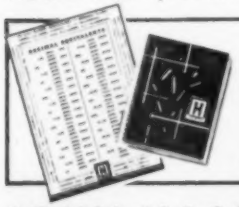

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MICRO LOCK

QUICK CAMLOCK + MICRO FINE ADJUSTMENT COMBINED

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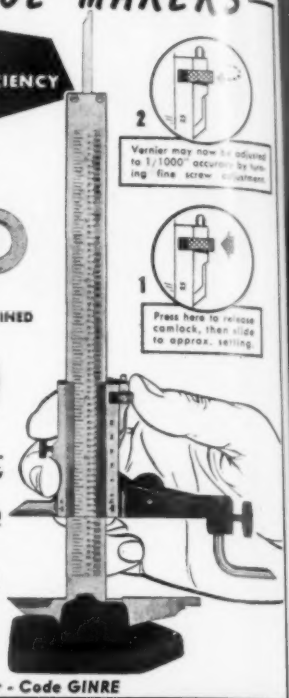
2
Vernier may now be adjusted to 1/1000" accuracy by turning fine screw adjustment
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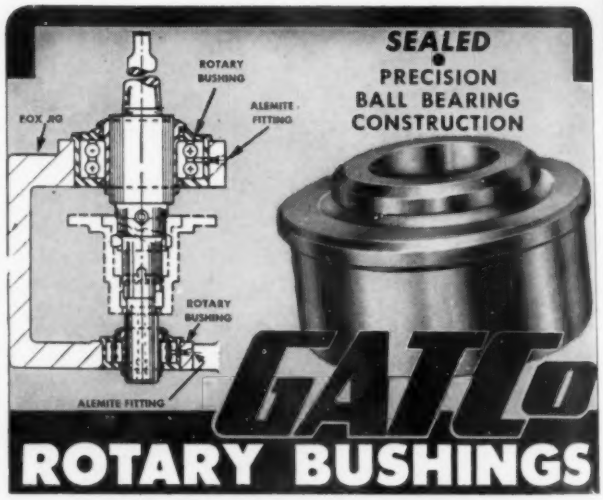

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protects fingers by providing roomy gripping space on either side of the die shoe. This flange may be mounted flush or on the edge of the die set and is welded in place. *There is no extra charge for this valuable safety feature.*

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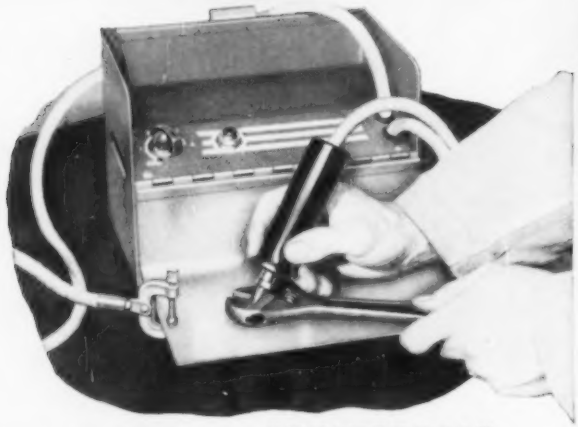

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Specify right or left hand

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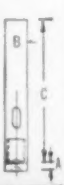

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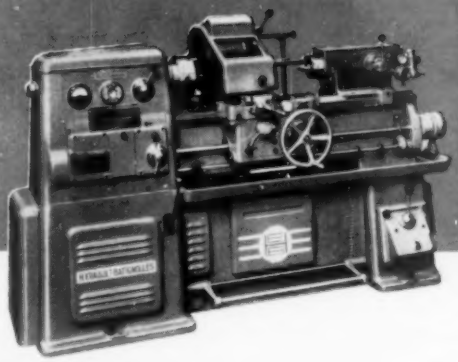

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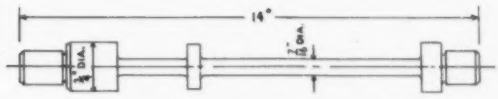

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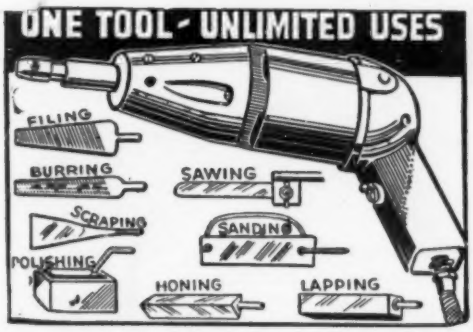

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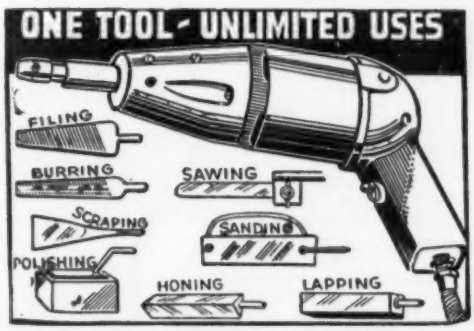

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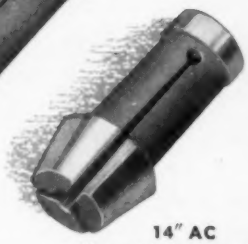

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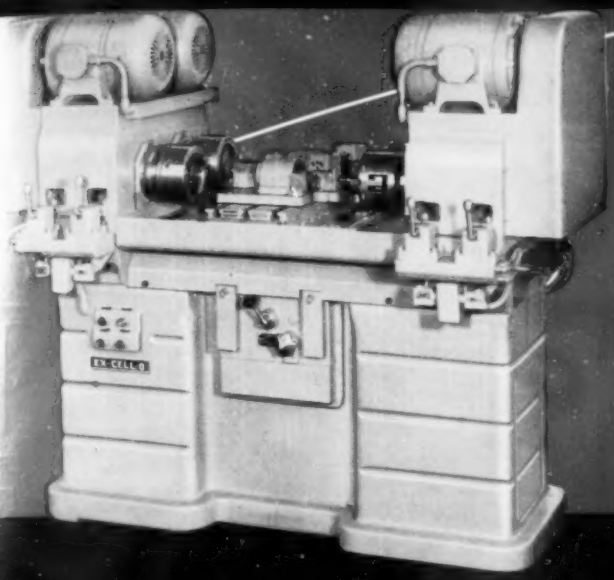

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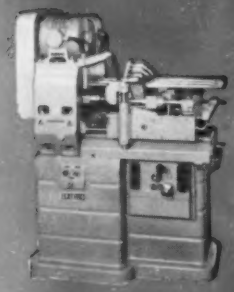
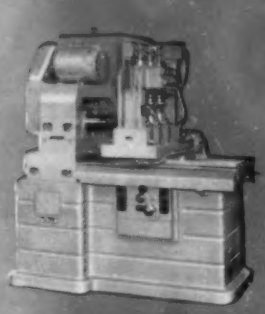
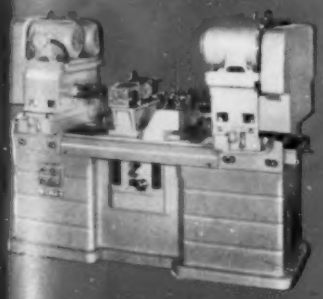


STYLE 2112-A. Single-end model for workpieces in the small and medium-size range. Flexible hydraulic controls give easy adjustment of multiple operations.



STYLE 112-C. Large and sturdy with long stroke. Accommodates medium and heavy work, gives maximum precision production, minimum operating cost.



STYLE 17. Massive construction. Maintains the highest precision standards on a profitable production basis. Economical in operation, can be set up for variety of jobs.

With this versatile equipment, you can precision bore, turn, face, counterbore, chamfer, and groove.

These machines are standard, yet they'll handle a large variety of precision operations. Ex-Cell-O also has the standard items of tooling to make this possible at minimum cost.

These fast, sturdy, flexible Ex-Cell-O machines are *profit insurance*. For years to come they will keep on turning out *precision work at maximum production speeds.*

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BORING MACHINES

Get all the facts about them from your local Ex-Cell-O representative, or write for a Precision Boring Catalog.

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AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

54-2

Illustrated is a 250 ton Verson TRANSMAT Press used by a leading manufacturer of automotive parts for making sealed beam headlight housings. Developed blanks are fed by a Verson Automatic Stack Feed and six operations are performed. Production is 1080 pieces per hour.

ANOTHER EXAMPLE OF HOW Verson TRANSMAT PRESS cut costs in mass production

- Eliminate handling, pickling, and annealing between operations
- Provide greater uniformity
- Minimize rejects
- Conserve floor space
- Minimize scrap loss
- Reduce Maintenance

Since the first Verson TRANSMAT Press was made fifteen years ago, owners have found that these machines are unmatched as cost-cutters where production requirements are high. With the TRANSMAT it is possible to automatically draw, form, punch and trim parts from developed blanks or from coil stock, whichever affords the greater scrap economy. As many as ten operations are being performed without intermediate handling . . . one press and one operator doing the work of several in a minimum amount of space. Automatic feeding puts an end to the human errors that accompany hand feeding. Maintenance is limited to a single machine instead of several. Further, the use of TRANSMAT Presses is no longer limited to symmetrical or cylindrical parts. Rectangular and non-concentric parts can and have been successfully produced on TRANSMATS.

If you are a continuous every-day producer of metal stampings in large quantities, we would like to explain the economical advantages of Verson TRANSMAT Presses and Verson Dies. Call us, today.

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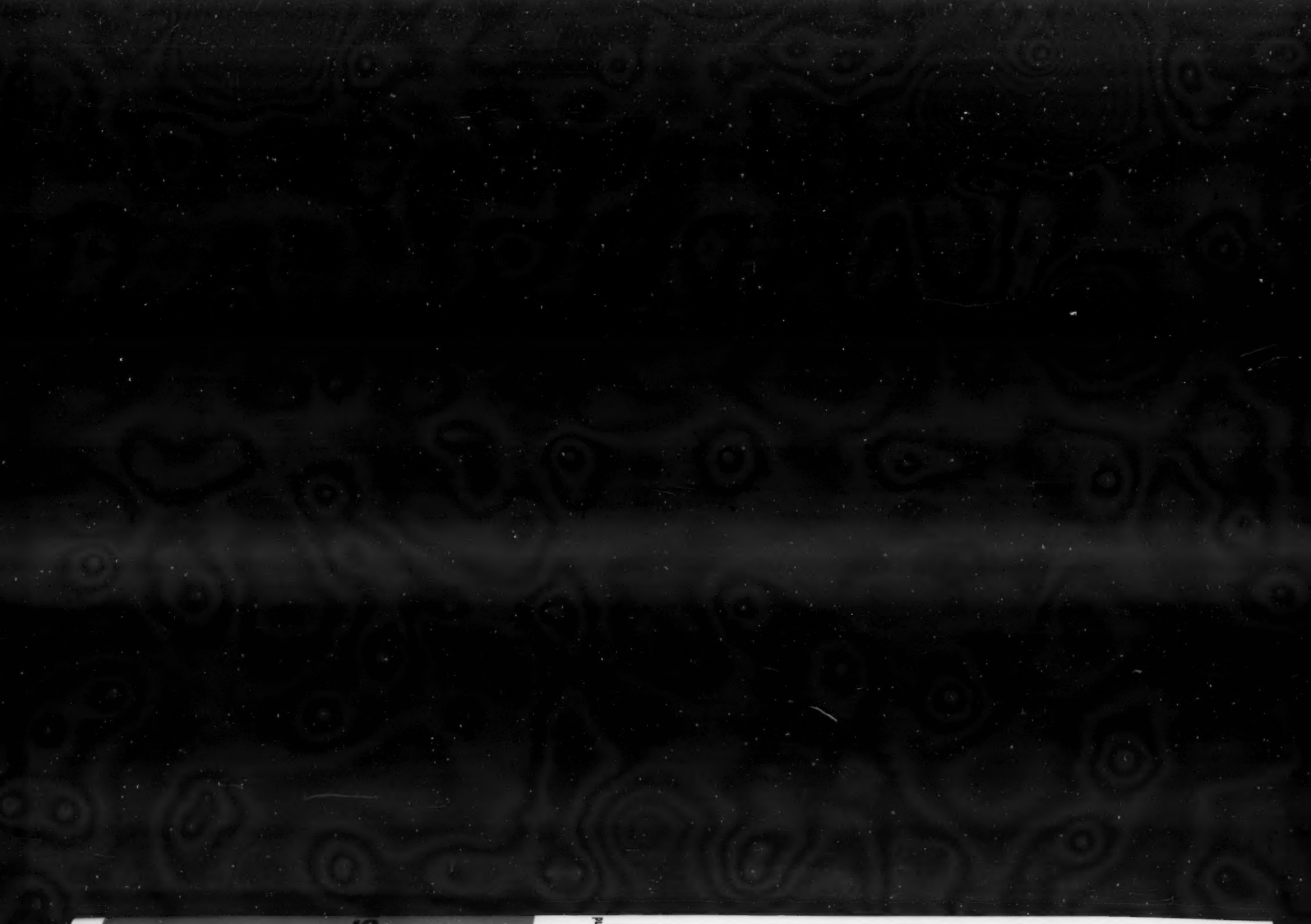
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